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ABSTRACT

A strategy that has been initiated to respond to assertions that out-of-date norms distort standardized achievement test results involves annually updating the norms for achievement tests to avoid the production of inflated scores through aging norms. The effect of the application of normative trend data to the obtained test results in an urban school district was evaluated. The analysis included data for the Spring 1988 administration of the California Achievement Test (CAT), Form E, in reading (n=54,871) and mathematics (n=17,722). The district participated, with a number of other schools, in CTB/McGraw Hill's Normative Trend Data (NTD) project, which involved renorming the CAT for that year. Data were then applied to the original results to transform the obtained frequency distributions for each subtest at each grade. Redistributed scores were then compared to the original distributions to assess the impact of the updated norms. The use of NTD data resulted in lowering the measure of achievement levels in reading and mathematics. NTD scores positively skewed the district's grade level achievement distributions. Annual national performance appeared to improve relative to the original standardization sample. Longitudinal comparisons for the district must, however, rely on the original standardization, and the interpretation and explanation of two sets of scores in a district compromise the utility of the results. An appendix contains 55 figures illustrating test score distributions. (SLD)

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Current Norms: Do They "Deflate" Test Scores?

A Study of Normative Trend Data for an Urban School District

James F. Lanese
Cleveland Public Schools

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Paper presented at the annual meeting of the American Educational Research Association, Boston, April 20, 1990

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ABSTRACT

Introduction

Recent criticism of the use of standardized achievement test results among school district nationwide by the Friends for Education has indicated that none of the 50 states reported being the below norm (Cannell, 1988). These allegations have fostered numerous studies and strategies among members of the education and testing communities to respond to these assertions (Koretz, 1988; Linn, 1989; and Shepard, 1989 among others). One strategy which has been suggested and initiated is that of annually updating the norms for achievement tests to avoid the phenomenon of aging norms producing inflated scores. The Normative Trend Data program made available by CTB/McGraw-Hill for its customers is one example of this strategy; annual test results of participant districts are utilized to illustrate changes in national averages in achievement for those taking the CTB tests.

The purpose of this study was to evaluate the effect of the application of normative trend data to the obtained test results in an urban school district.

The study sought to respond to the following questions concerning the utilization of normative trend data.

1. What affect would the use of updated norms have upon the district-wide achievement test results in reading and mathematics?

2. Does comparing (transforming) scores with updated normative data 'normalize' the score distributions of district-wide achievement results (as Friends for Education would prefer)?

Methodology

The methods employed included the analysis of the district's complete available test results file for the Spring, 1988 administration of the California Achievement Test (Form E) in reading (n = 54,871) and mathematics (n = 17,722) in selected grade levels. The district participated in the publisher's Normative Trend Data Project which involved the "renorming" of the CAT for that year. The data which was made available to the district from this effort was then applied to the original results to "transform" the obtained frequency distributions for each subtest at each grade. The redistributed scores (in local quartiles) were then compared to the original distributions to assess the impact of the updated norms.

Findings

Based upon original norms, the local quartile performance of district's grade one through 11 students fell below the national quartile levels in reading in all but five of the 99 comparisons.

In mathematics, however, 21 of the 63 quartile comparisons made found local performances equal to or greater than original normed quartiles.

Using NTD scores, local reading quartile performances remained below the norm; further, NTD scores indicated a lowering of quartile levels (from original norms) in 63 of the 99 comparisons.

Applying NTD standards in mathematics, only three of the 63 comparisons remained above the normed levels; NTD quartiles were lower than the original norms in all comparisons.

Similar findings concerning the median score levels were evident in the graphic score distributions contained in the study's appendix.

Conclusions

The use of Normative Trend Data to interpret test scores resulted in a lowering of the measure of achievement levels in the district in reading and mathematics. NTD scores positively skewed the district's grade level achievement distributions.

Annual national performance in reading and mathematics appeared to improve since the original test norming (based upon the reinterpreted quartile scores).

While the use of current norms might serve to satisfy many concerns related to the use of standardized test results as a measure of achievement, the practicality of using two sets of norms for the measure of achievement in a school district is debatable.

: Current Norms: Do They "Deflate" Test Scores?

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Introduction

Recent criticism of the use of standardized achievement test results among school districts nationwide by the Friends for Education has indicated that none of the 50 states reported being the below norm (Cannell, 1988). These allegations have fostered numerous studies and strategies among members of the education and testing communities to respond to these assertions (Koretz, 1988; Linn, 1989; and Shepard, 1989 among others). One strategy which has been suggested and initiated is that of annually updating the norms for achievement tests to avoid the phenomenon of aging norms producing inflated scores. The Normative Trend Data program made available by CTB/ McGraw-Hill for its customers is one example of this strategy; annual test results of participant districts are utilized to illustrate changes in national averages in achievement for those taking the CTB tests.

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Review of the Literature

In 1988, John Jacob Cannell reported that "no state is below the norm at the elementary level on any of the six major nationally normed, commercially available tests!" This statement resulted from a study which his organization, Friends for Education, conducted in response to a perceived discrepancy between the performance of students in the West Virginia schools on nationally normed achievement tests and the state's citizens' performance on other education achievement indicators (college degrees, ACT results, and per capita income levels). Cannell wondered how this discrepancy could exist in his and, literally, most of the 49 other states in the union. Cannell went on to analyze the phenomenon by making the following allegations concerning the use and interpretation of standardized achievement tests. While "educators claim that the high scores reflect improved achievement levels, Friends for Education suspects that inaccurate initial norms and teaching the test may be the reasons for high scores" (Cannell, 1988). Subsequently, members of the education community (Phillips and Finn, 1988; and Stonehill, 1988) and the test and measurement community (Drahozal and Frisbie, 1988; Lenke and Keene, 1988; Williams, 1988; and Qualls-Payne, 1988) responded in force.

While most concurred with Dr. Cannell's findings, they sought to defend the use of normed referenced tests and their legitimacy as a valid measure for school children's achievement. One recurrent theme among all respondents was the issue of the recency of the test norms. Koretz (1988) recognized this issue as a function of the test publishing cycle. "[N]orms become increasingly dated until a new [test] edition is introduced. Students are compared to a national standard that is sometimes more than half a decade out of date" (Koretz, 1988). "Obviously, those who compare the 1987

performance of their pupils with that of other pupils who were tested in 1978 (national standardization) will be using 'softer' norms and will have more pupils appearing to be above the national average than really are" (Drahozal and Frisbie, 1988). This phenomenon might be best addressed by more frequent renorming of tests or even annual norming of standardized achievement tests. Three of the four testing company respondents indicated that the provision of annual norms was already available or currently under development. Although these 'updated norms' cannot be used in place of the original standardization norms "[s]uch data could be used to amplify the standardization norms and provide a more complete picture on the progress local school districts were making in their instructional efforts" (Williams, 1988).

Methodology

The methods employed included the analysis of the district's complete available test results file for the Spring, 1988 administration of the California Achievement Test (Form E) in reading (n = 54,871) and mathematics (n = 17,722) in selected grade levels. These test results represent an annual district-wide testing effort at grades one through 11 in reading and at grades three through nine in mathematics. The reading test was administered to approximately 80 percent of the district's 68,000 pupil enrollment in grades one through 12 in 1988 (only results for grades one through 11 were utilized in this study). The enrolled population was 70 percent black, 23 percent white, five percent Hispanic, and two percent other races in 1988. Similar testing rates were evident among the mathematics results obtained for this study.

Normative Trend Data Project

CTB-McGraw-Hill, the publishers of the California Achievement Test invited all users to participate in its normative trend data (NTD) program by

availing the publisher of the current test results data. CTB aggregated the available (n 95,000 to 160,000 per grade) data using their original norming stratification design in order to produce 1988 NTD percentile and NCE tables for scoring and interpretation. Use of the "updated" norms was cautioned as follows.

Sampling techniques varied between the tests' original standardization and the NTD. The respective representativeness was unknown. Grade level test usage was varied, therefore sample variations among grades was evident. Urban stratification cells appeared to be under-represented thereby affecting the NTD samples. Finally, test familiarity among users affected the representativeness of the NTD sample (See Roudabush, 1989).

The Cleveland School District Data

Upon completion of the NTD project, CTB provided the school district with current (1988) national percentile rank values which corresponded to the original normed percentile ranks of the district's local quartile cut points. Tables 1 and 2 illustrate the respective 1986 (original norm) percentile rank and 1988 (NTD) percentile rank corresponding to the District's local 25th, 50th and 75th percentile for reading and mathematics subtests in selected grades. For example, a full 75 percent of those students tested in grade three vocabulary scored at or below the 61st percentile rank ('86 norm). These students scored at or below the 59th percentile rank per NTD ('88) norms.

Additionally, data for each of the subtests per grade were aggregated and plotted. A graphic comparison of these results focused upon the median scores for reading and mathematics (see Appendix A). Distributions of each subtest at each grade were plotted with reference marks at the 50th percentile rank (national norm). The district's median scores (50th local

Table 1

Cleveland City School District
1988 CAT Reading Test
Comparative Percentile Ranks
Local, National, and NTD Quartiles

Grade	Local %ile	Vocabulary Norm('86)	Vocabulary NTD('88)	Comprehension Norm('86)	Comprehension NTD('88)	Total Reading Norm('86)	Total Reading NTD('88)
1	25	15	14	17	17	13	17
1	50	37	37	43	41	43	40
1	75	69	66	67	64	71	66
2	25	18	16	18	17	20	19
2	50	38	36	34	35	37	37
2	75	61	58	59	56	62	60
3	25	22	19	25	19	24	20
3	50	39	36	41	35	42	39
3	75	61	59	67	63	63	61
4	25	22	18	25	18	24	19
4	50	36	34	39	35	39	36
4	75	58	56	58	58	59	58
5	25	20	17	26	20	24	19
5	50	34	31	40	36	39	34
5	75	57	55	60	56	58	56
6	25	21	19	28	20	21	20
6	50	38	39	43	38	42	38
6	75	58	59	62	58	61	61
7	25	15	13	24	18	20	16
7	50	29	29	38	34	33	31
7	75	51	52	58	58	52	53
8	25	20	18	24	19	20	17
8	50	35	34	39	38	36	35
8	75	54	55	58	56	56	56
9	25	17	15	20	15	18	15
9	50	30	31	36	31	32	31
9	75	53	56	55	51	51	52
10	25	17	17	24	21	19	18
10	50	32	35	39	39	36	36
10	75	56	60	61	62	59	59
11	25	17	16	26	20	19	17
11	50	32	33	44	34	32	35
11	75	52	54	59	52	56	55

Table 2

Cleveland City School District
1988 CAT Mathematics Test
Comparative Percentile Ranks
Local, National, and NTD Quartiles

Grade	Local %ile	Computation Norm('86)	Computation NTD('88)	Concepts & Application Norm('86)	Concepts & Application NTD('88)	Total Mathematics Norm('86)	Total Mathematics NTD('88)
3	25	14	7	19	12	20	12
3	50	33	22	38	29	40	29
3	75	76	62	61	51	73	60
4	25	32	20	27	18	28	19
4	50	56	41	45	36	50	39
4	75	81	71	65	57	72	62
5	25	32	21	26	17	31	20
5	50	54	41	48	37	53	41
5	75	76	66	67	57	75	65
6	25	46	35	24	16	37	27
6	50	64	56	48	40	59	51
6	75	84	79	67	60	77	71
7	25	27	18	22	16	25	17
7	50	43	35	39	33	42	34
7	75	65	56	55	49	61	54
8	25	22	17	19	15	21	16
8	50	35	30	39	35	41	37
8	75	58	54	56	53	62	58
9	25	13	7	12	7	15	9
9	50	26	19	22	16	27	21
9	75	46	39	42	35	46	41

percentile) in terms of nationally normed and NTD scores were then superimposed on the distributions.

Findings

By the comparison, the District's local quartile performance was below nationally normed quartile levels in all cases (n = 33) compared in grades one through 11 in reading vocabulary.

Comparisons of the local quartile performances in reading comprehension indicated only five cases where the local lowest quartile met or exceeded the national norm quartile. All others (n=28) compared to a lower national normed percentile rank.

The reading total local quartile performances were below the nationally normed quartile levels in all cases compared (n = 33).

The second set of comparisons involved the local quartiles with the NTD quartile levels. Two types of observations emerged from this comparison. First, in all cases of vocabulary, reading comprehension, and total reading quartiles reviewed, local quartiles performances remained below the NTD quartile levels. Secondly, in only 28 of the 99 comparisons made, NTD scores equalled (N=13) or exceeded (n=15) the original norm levels at each quartile. As a result, an original below-district norm performance status, in general, regressed further when compared to NTD scores.

The results of comparisons in mathematics scores were somewhat different. First, in 21 of the 63 comparisons of mathematics subtests and total results, local quartile performances equalled or exceeded the nationally normed level of 1986. In all other cases (n = 42) the local quartiles were below national levels.

Subsequent comparisons of local mathematics quartile performances with NTD scores indicated that only three of the 63 cases remained above the

normed score while all others fell below. Also, in all comparisons, the NTD score quartile levels were lower than original norm scores. Again a diminishing pupil performance record in mathematics was effected by utilizing NTD scores.

Score Distributions

The findings of the graphic comparisons reiterate those mentioned above. Specifically, the district's median for its local distribution in reading fell below the nationally normed median in all cases compared. Additionally, in all but ten cases, the district's reading distribution median declined further when compared to the NTD scores. Four of the 10 exceptions indicated no change while six evidenced one to three point improvements when referencing NTD scores.

Similar comparisons in the area of mathematics finds local medians at or above the national normed medians in the computation subtest and total test scores at three of the seven grades levels studied. When comparing the local median to NTD scores, only one grade level remained higher than the norm in computation and total test scores. In all cases, the median score declined when compared to NTD scores as apposed to the original norms.

Conclusions

The use of normative trend data to interpret local test scores resulted in a lowering of the measure of achievement levels in the district. With very few exceptions, reinterpreted (NTD) scores resulted in lower quartile levels for the District's pupils in reading and math. Additionally, score comparisons to "updated" NTD scores serve to positively skew the district's grade level distributions. In a district whose scores represent below normal status when compared to original test norms, NTD scores further skew the results.

The general trend of lower ranking distributions when utilizing NTD scores supported contentions of the test publishers and critics. The annual performances on standardized reading and mathematics tests appeared to improve relative to the original standardization sample. The use of more recent norms serve to interpret annual results of test users relative to their peers however, longitudinal comparisons must rely upon the original standardization. Additionally, it must be noted that NTD scores are compiled from a user sample and, therefore, do not reflect the same degree of representativeness evident in the original effort. The documented under-representation of the urban cells in the NTD sample may have contributed to the relative lowering of normed rankings over time.

Despite the notion that annual norms adequetly address the issues discussed in the literature, the interpretation and explanation of two sets of scores representing achievement testing in a district severely compromises their utility.

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APPENDIX A

1988 CAT - Reading and Mathematics
Test Score Distributions

1988 CAT Reading Test Plots

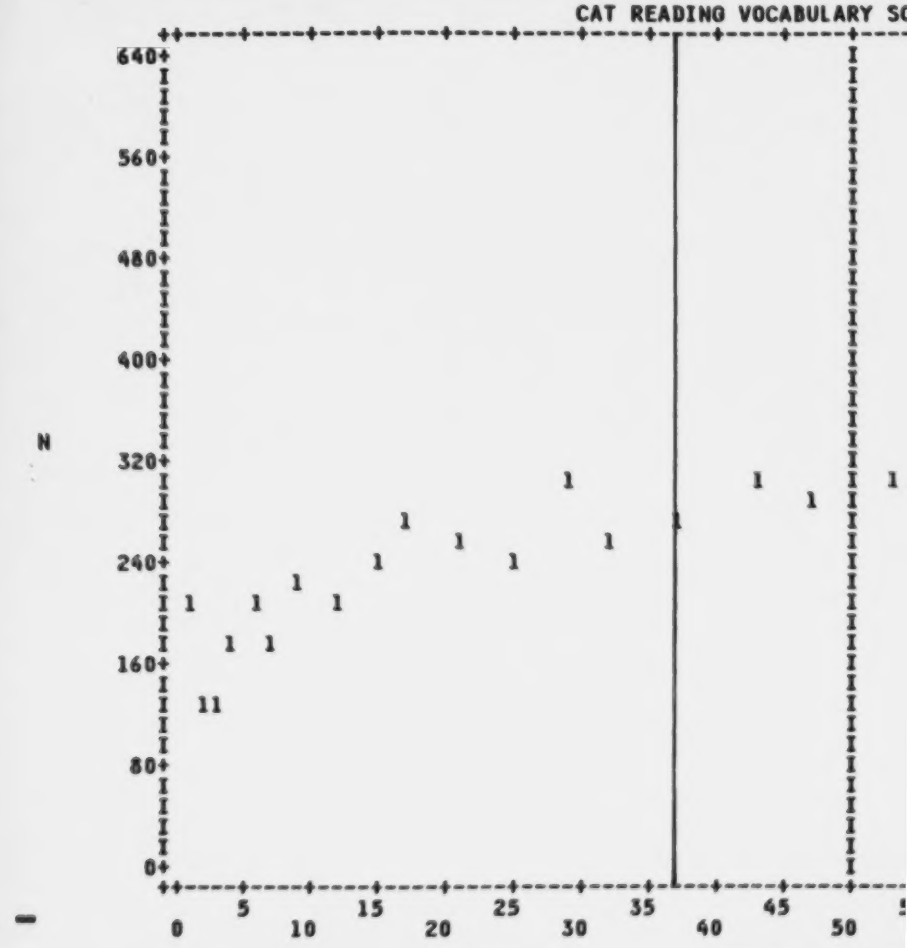
The plotted values represent aggregated frequencies of percentile rank scores for pupils tested in each grades.

Legend: I - National Norm Median

- Local Median per 1986 Norms

- Local Median per 1988 NTD

Note: Single solid line on the plot indicates '86 and NTD reference ranks are equal.



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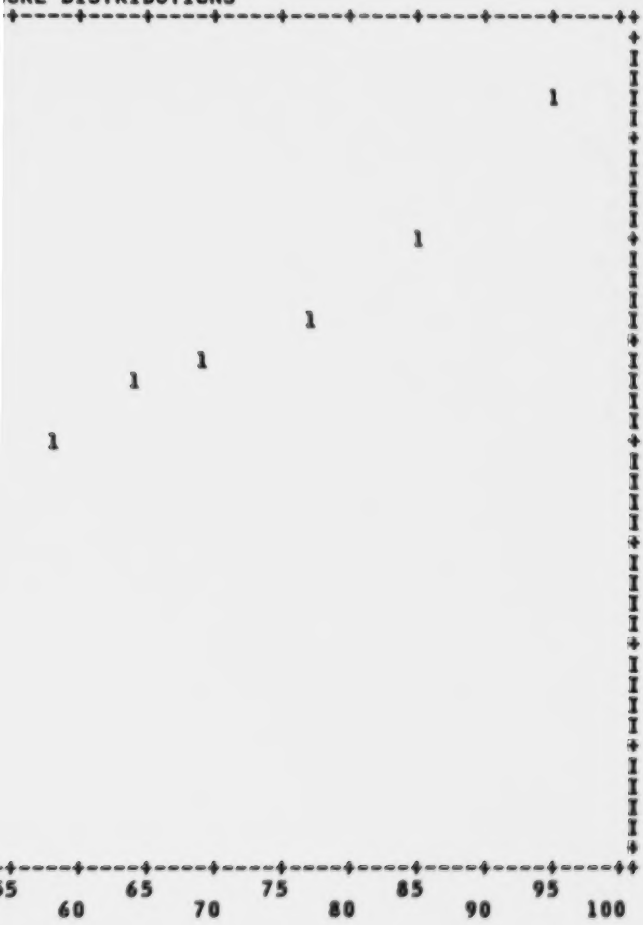

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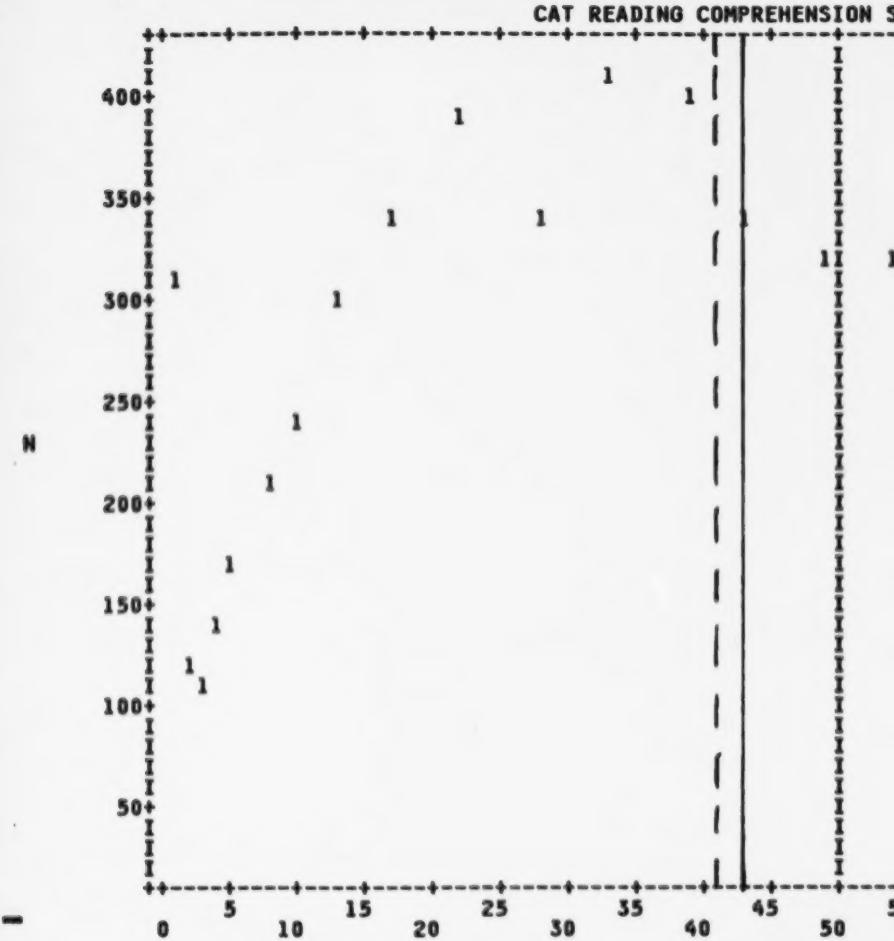

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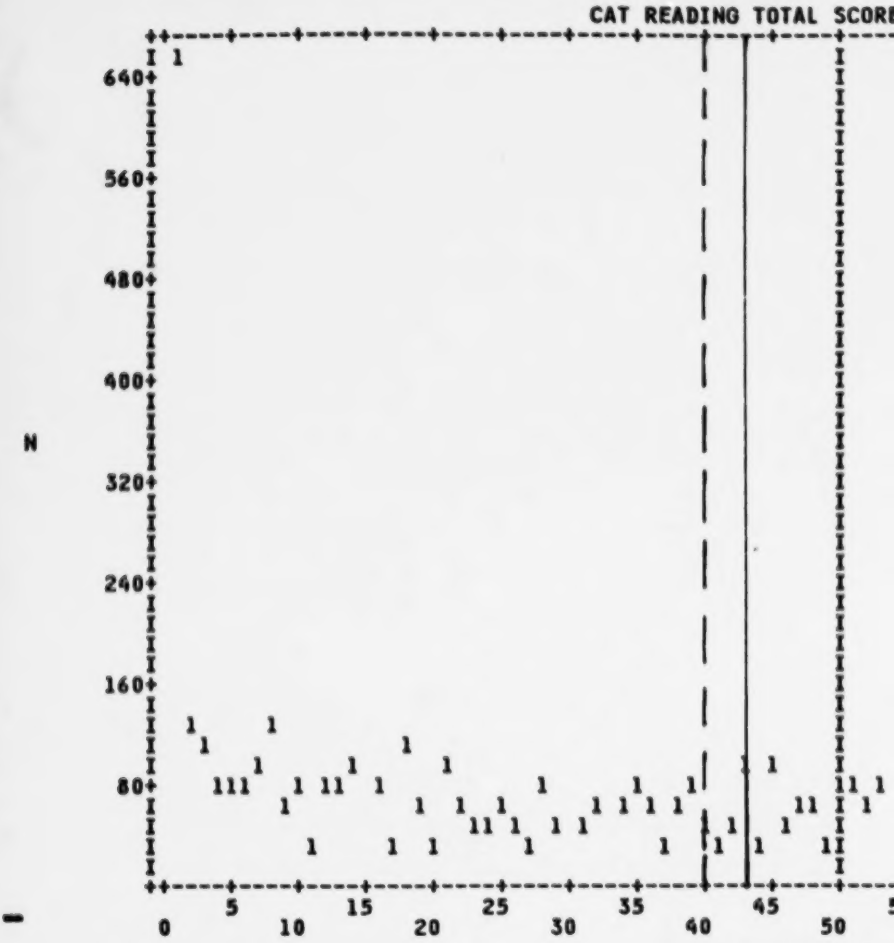

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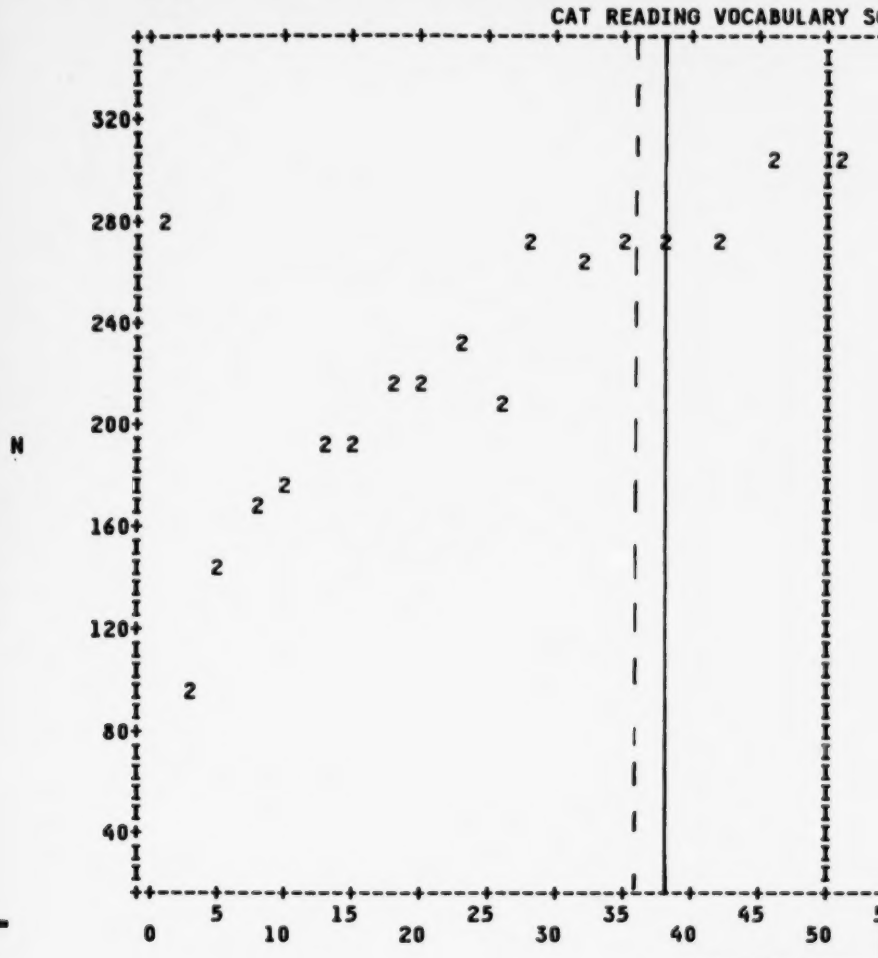

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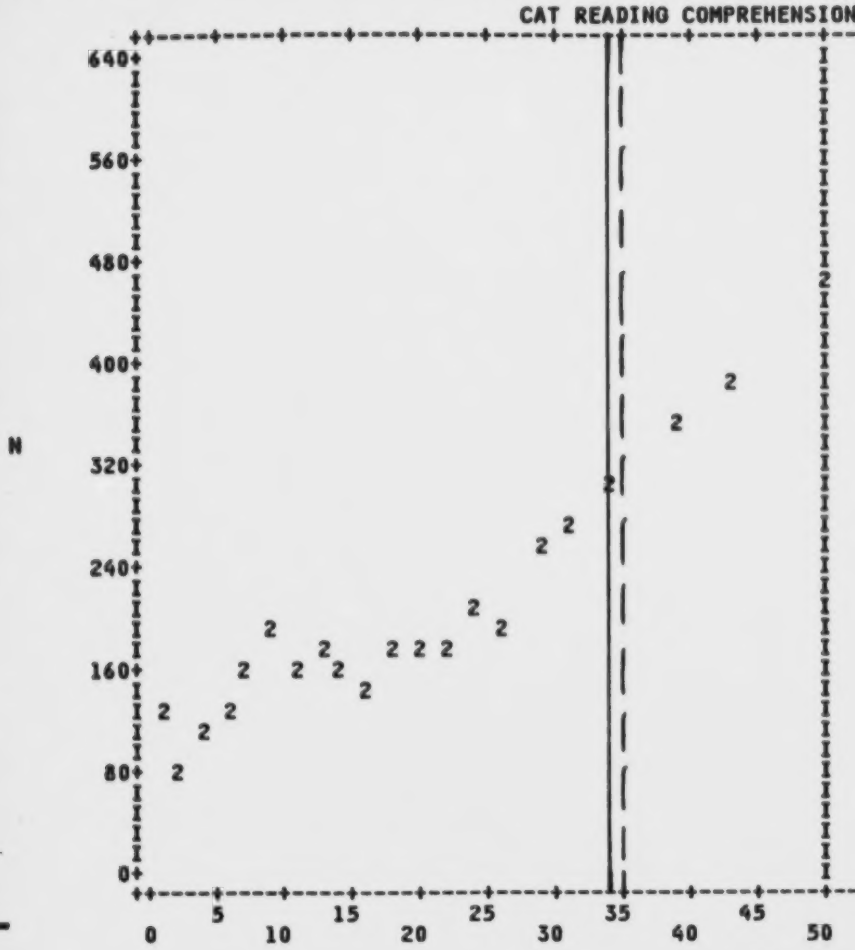

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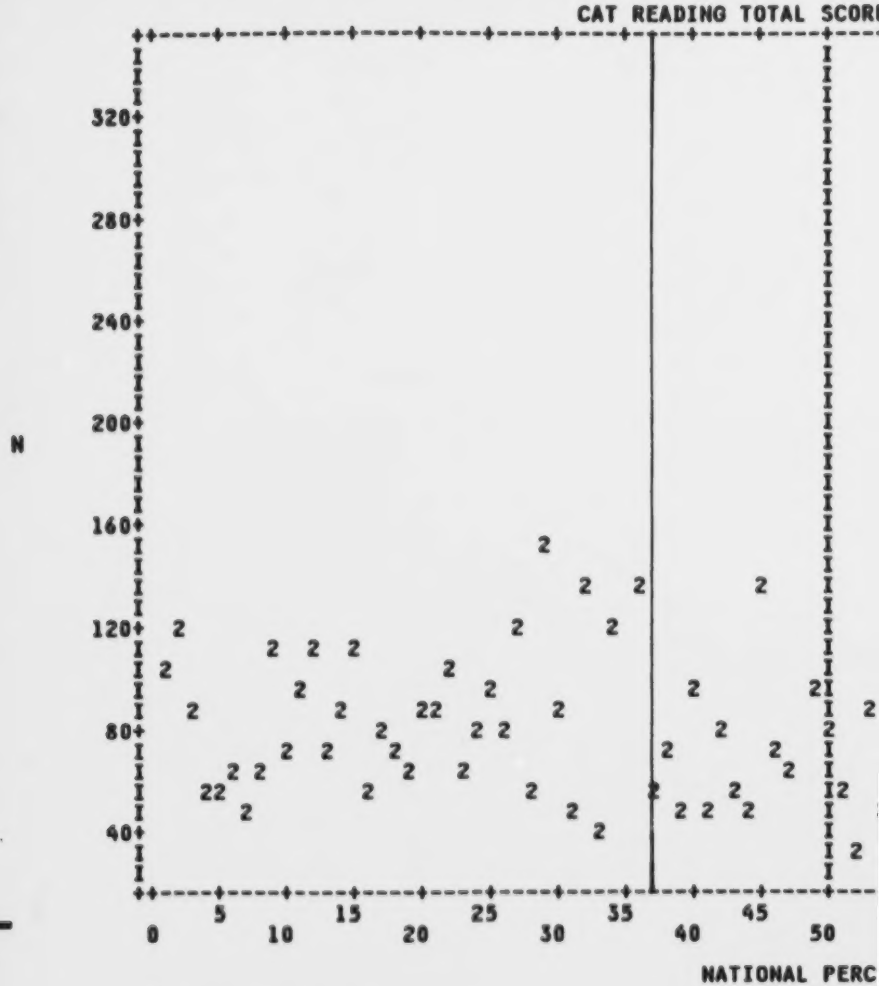

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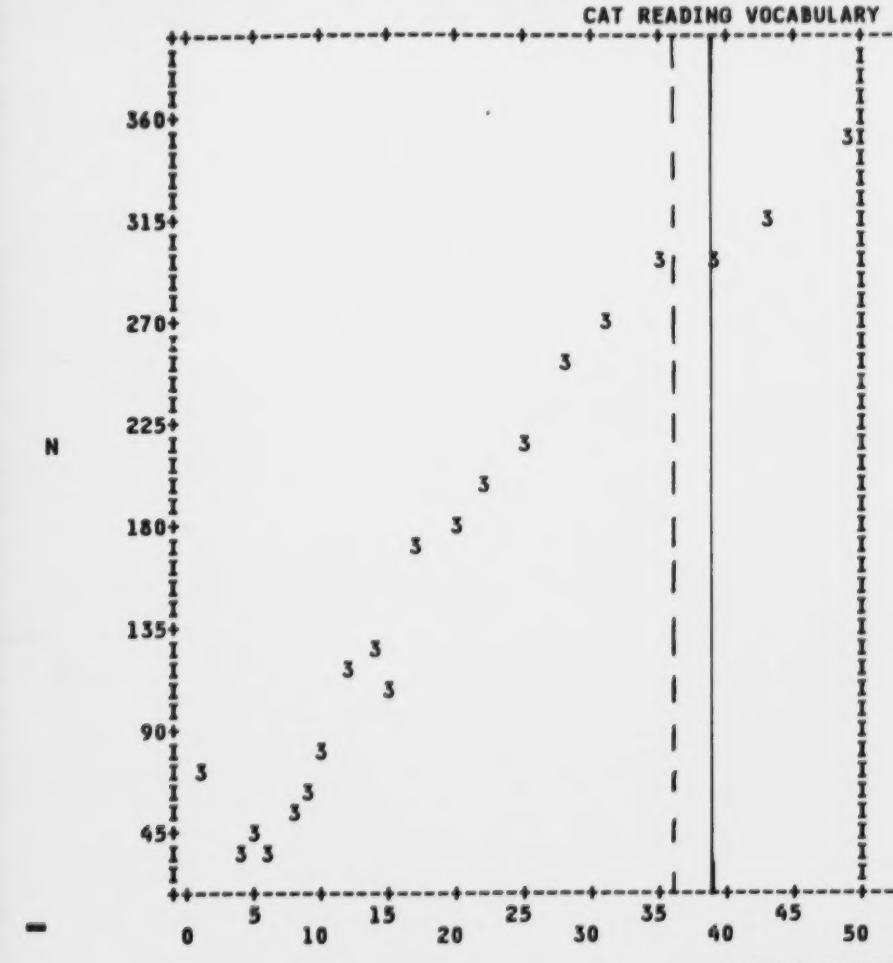

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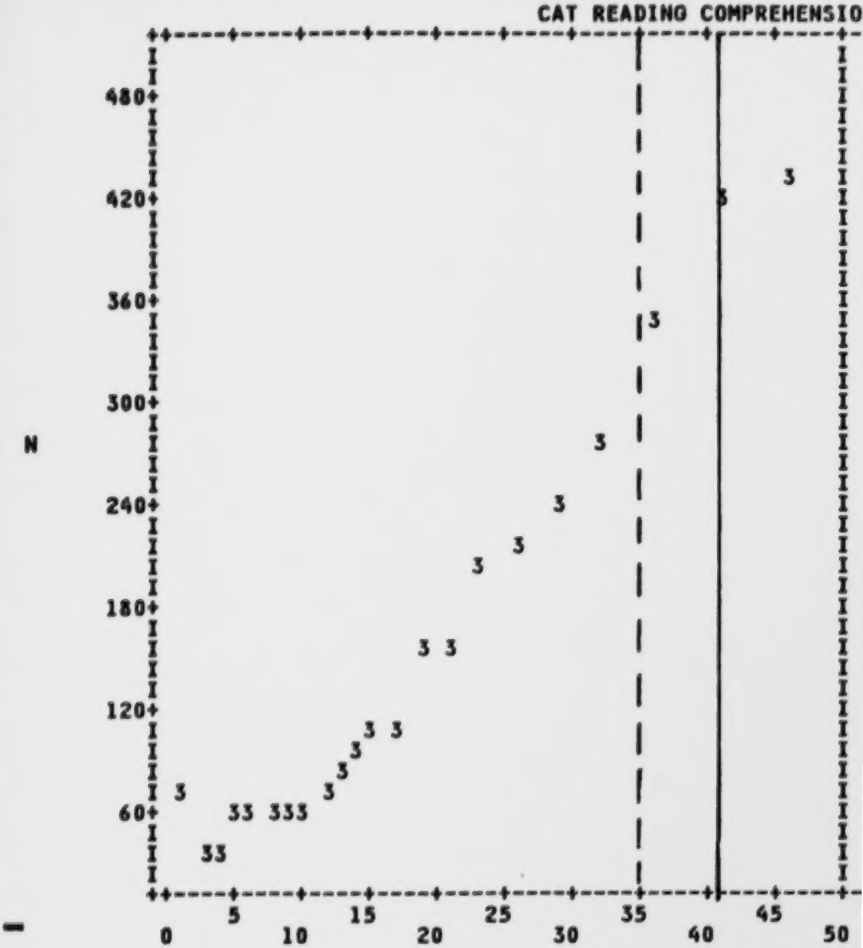

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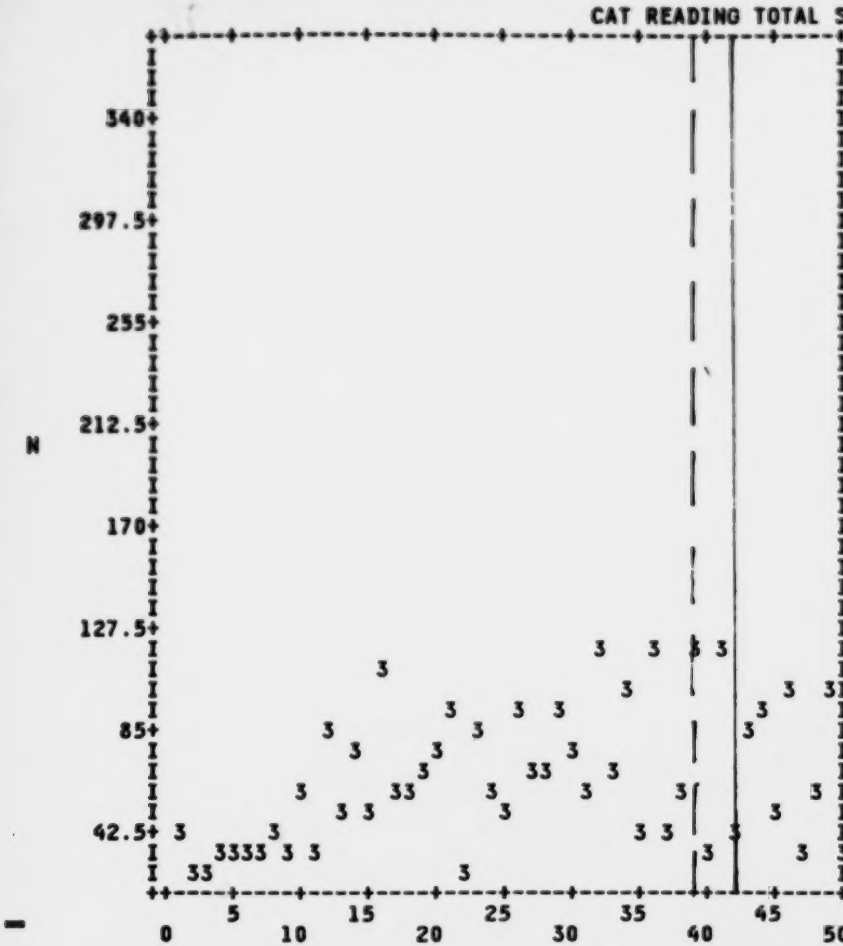

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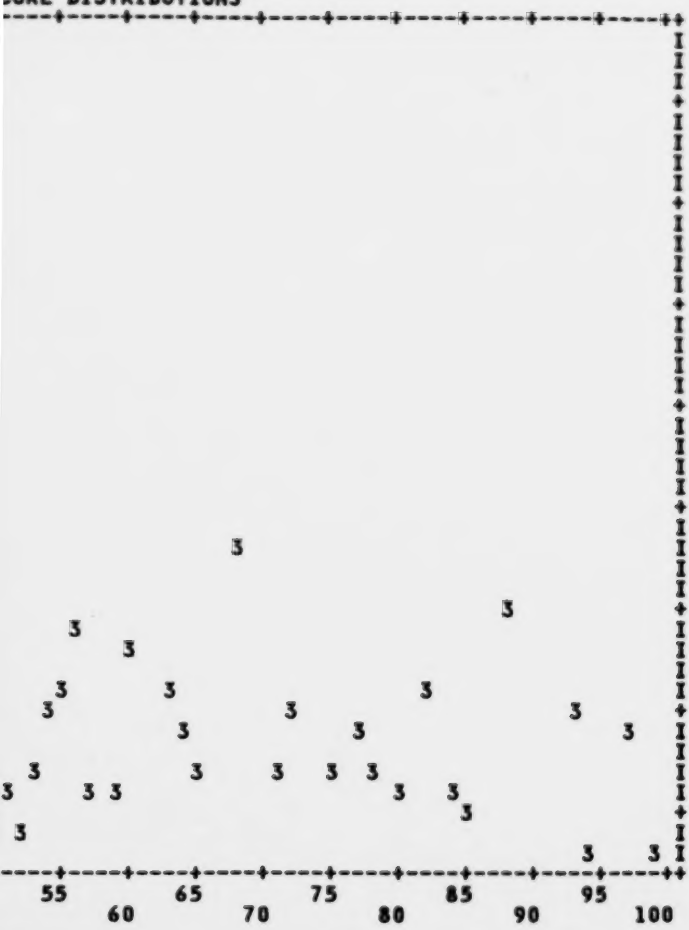

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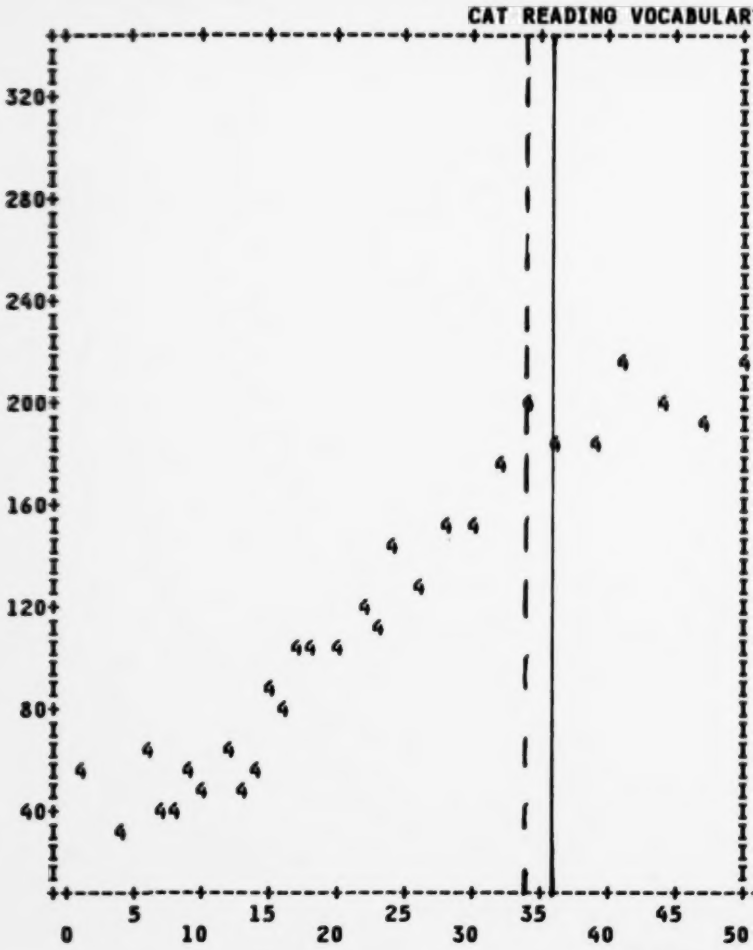

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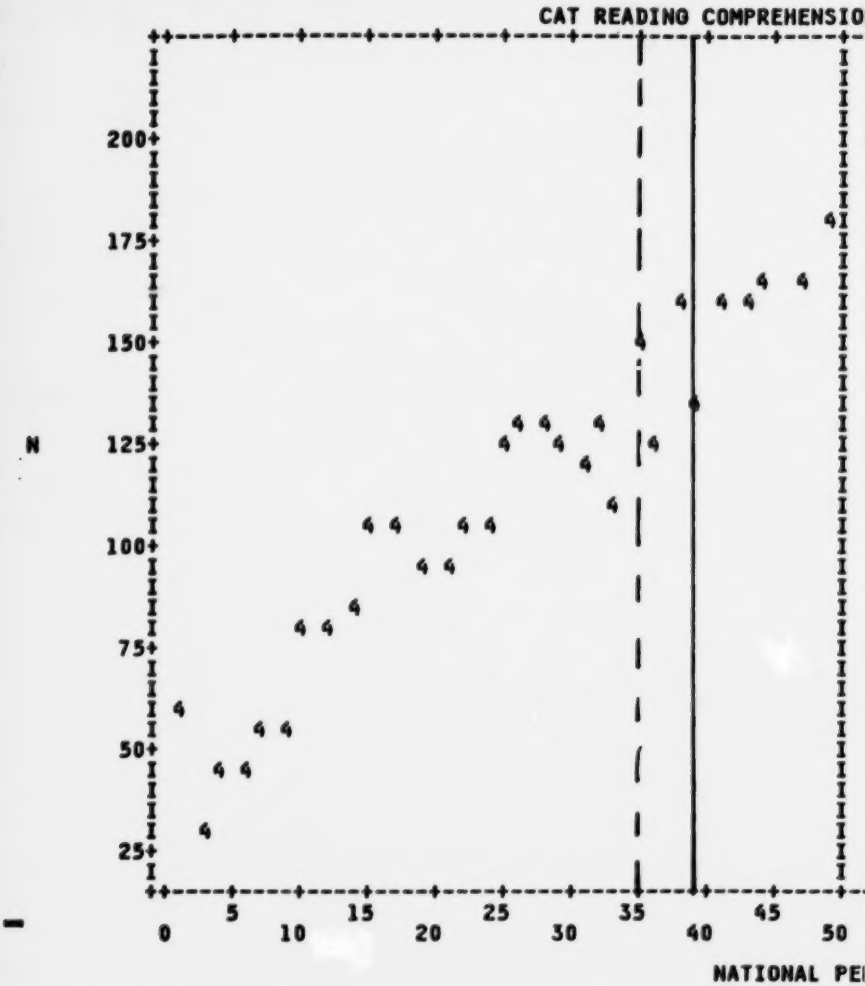
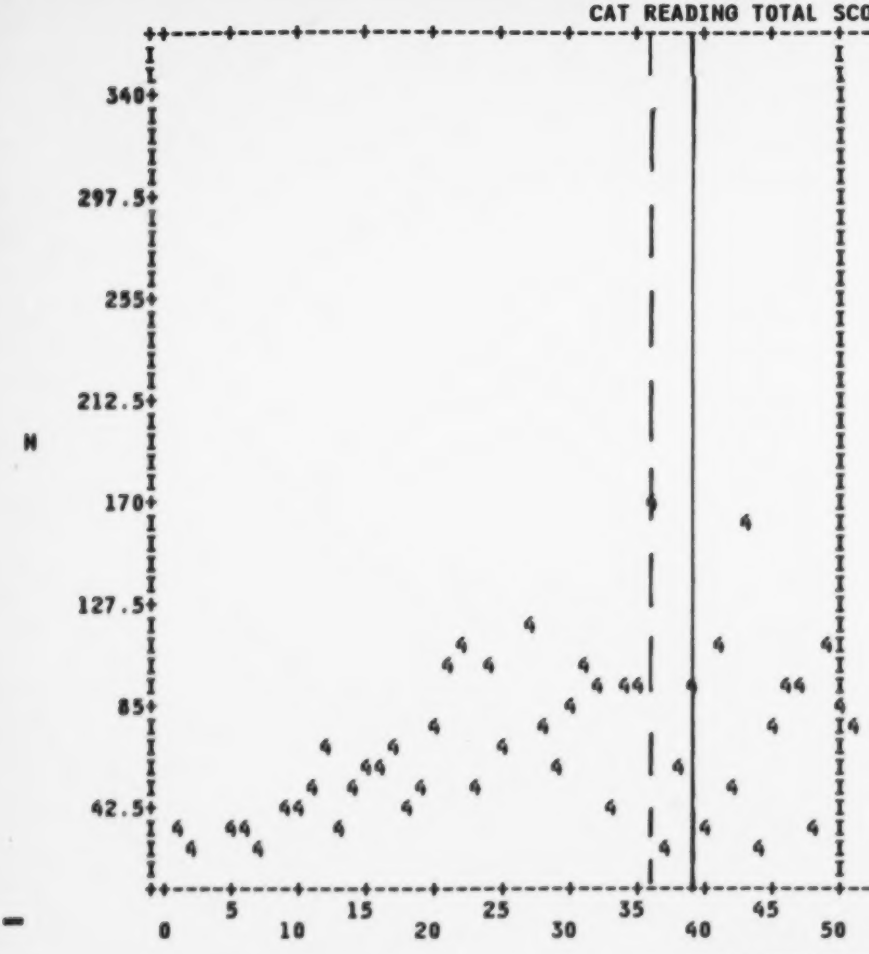


43 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND * FO

SCORE DISTRIBUTIONS

CENTILE

MULTIPLE OCCURRENCE.



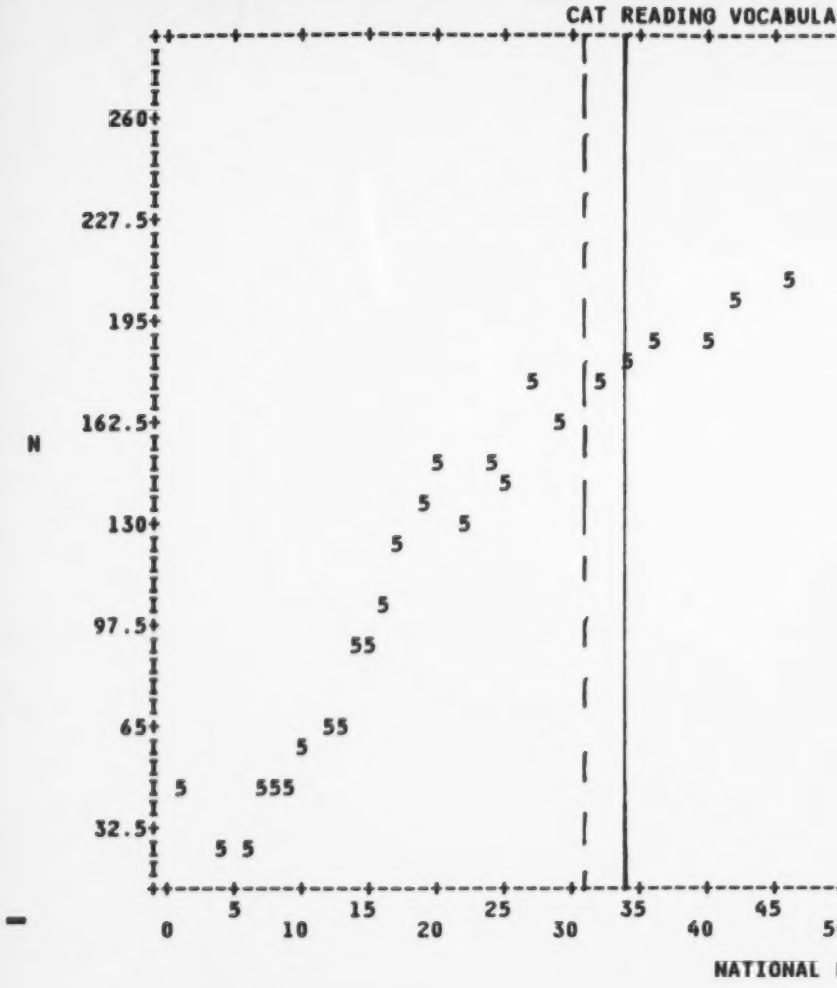
70 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0 FOR

RE DISTRIBUTIONS

CENTILE

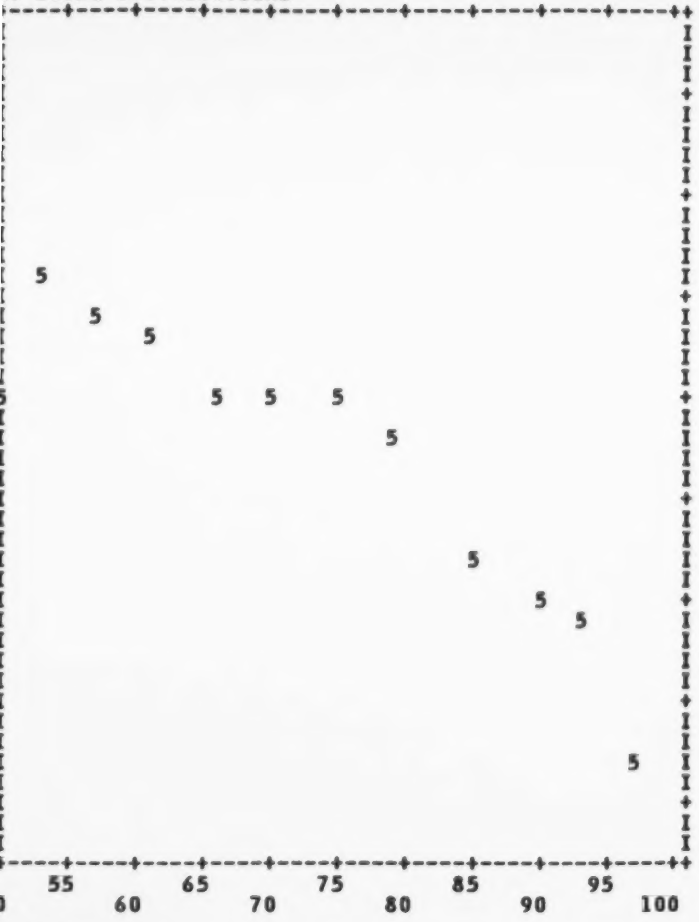
MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:51:35 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



38 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND #

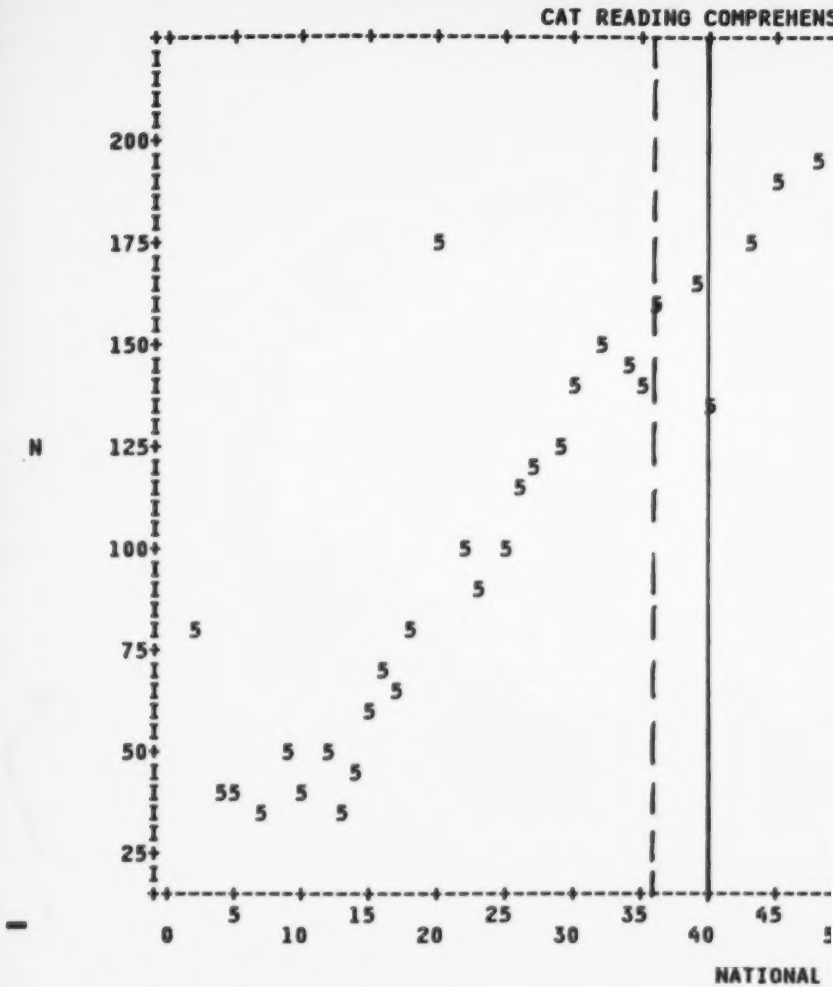
IY SCORE DISTRIBUTIONS



PERCENTILE

FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:47:12 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



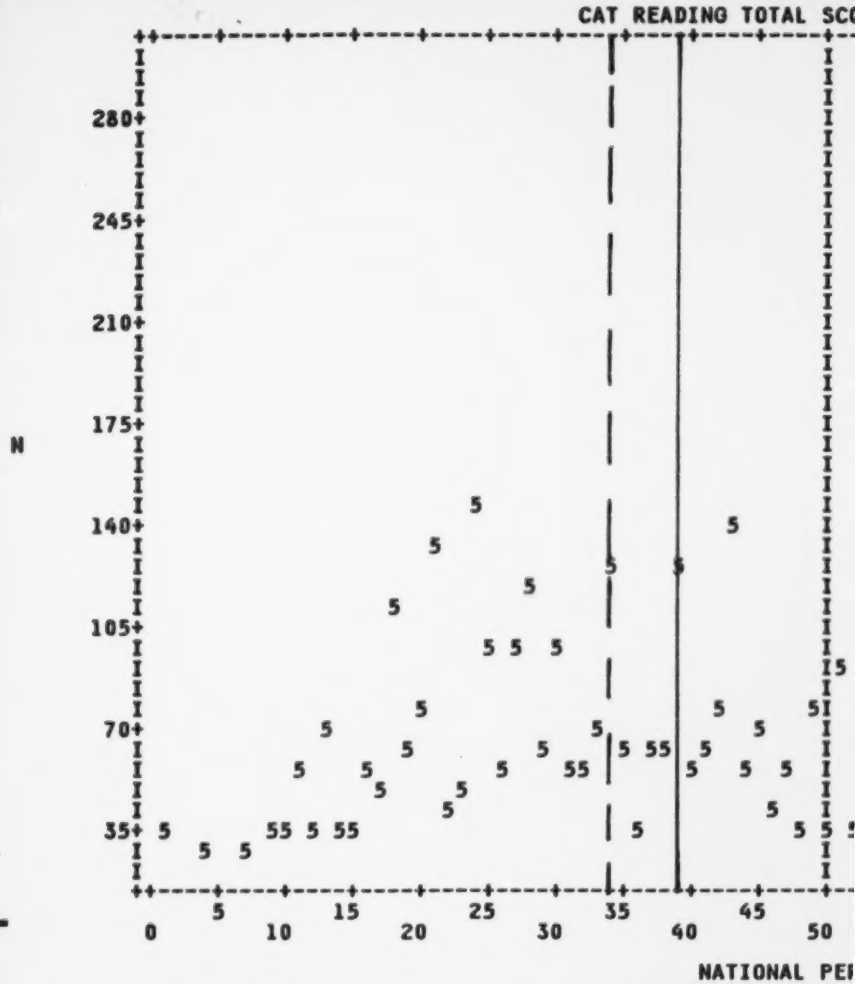
42 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND

ION SCORE DISTRIBUTIONS

PERCENTILE

FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:46:07 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



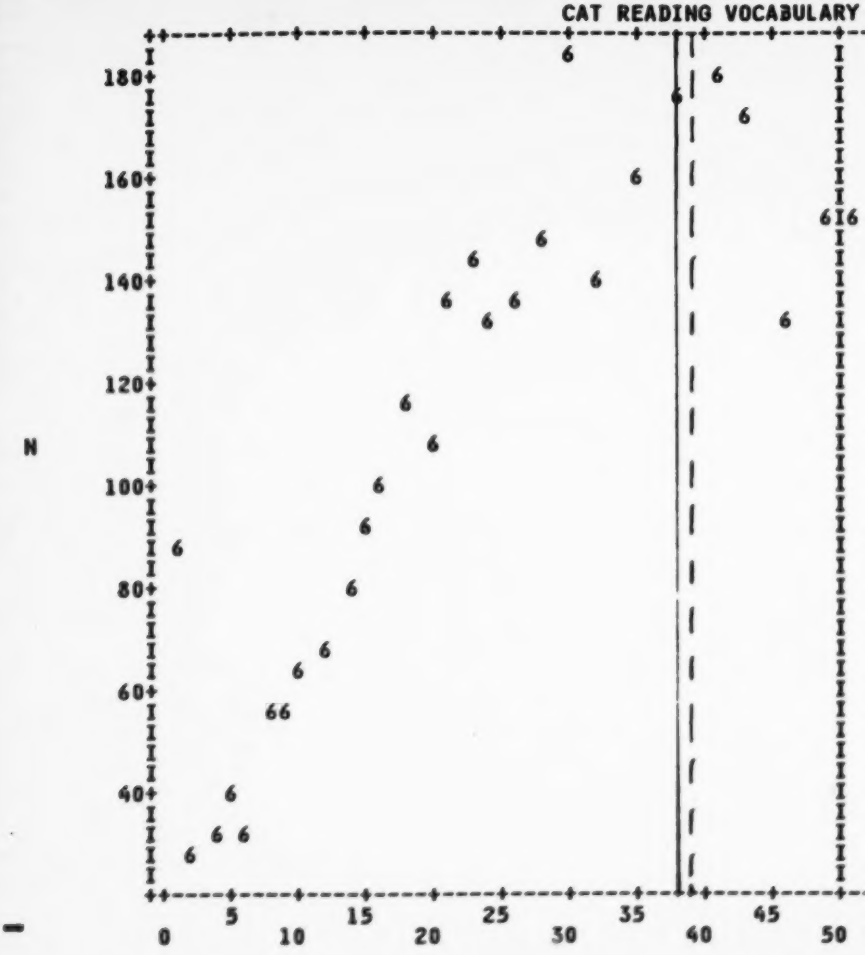
72 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND * FO

RE DISTRIBUTIONS

CENTILE

MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:51:35 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



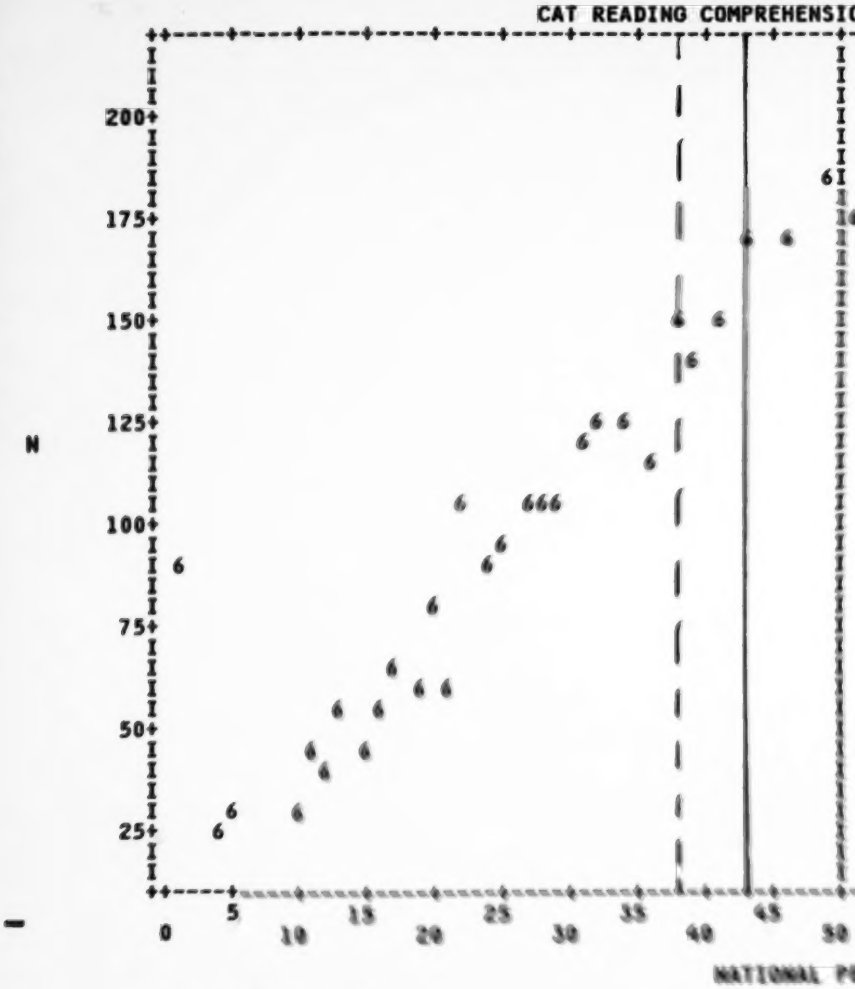
42 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND * FO

SCORE DISTRIBUTIONS

RCENTILE

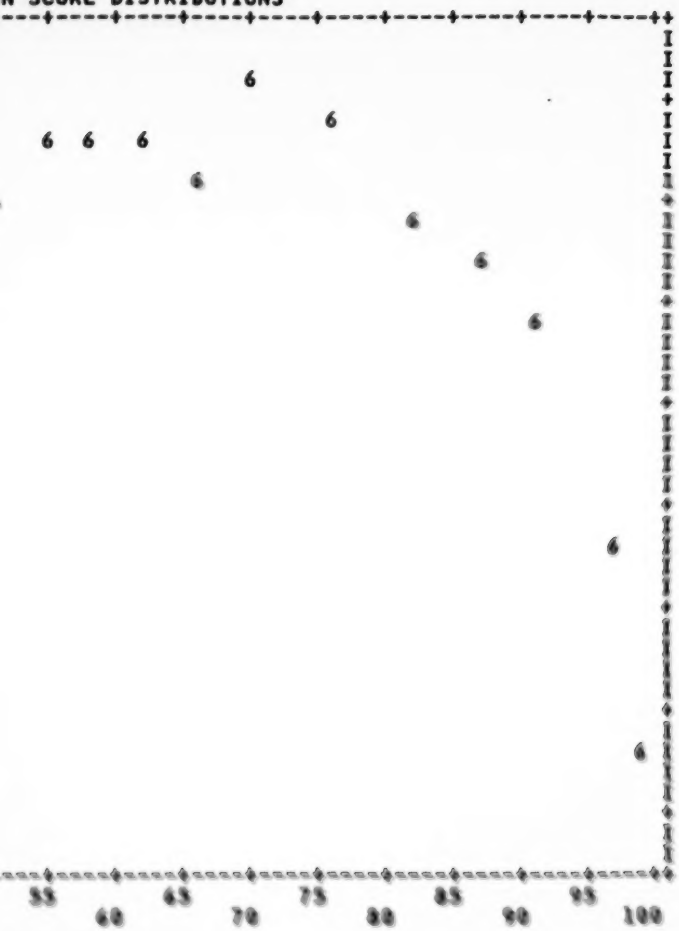
MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:47:12 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



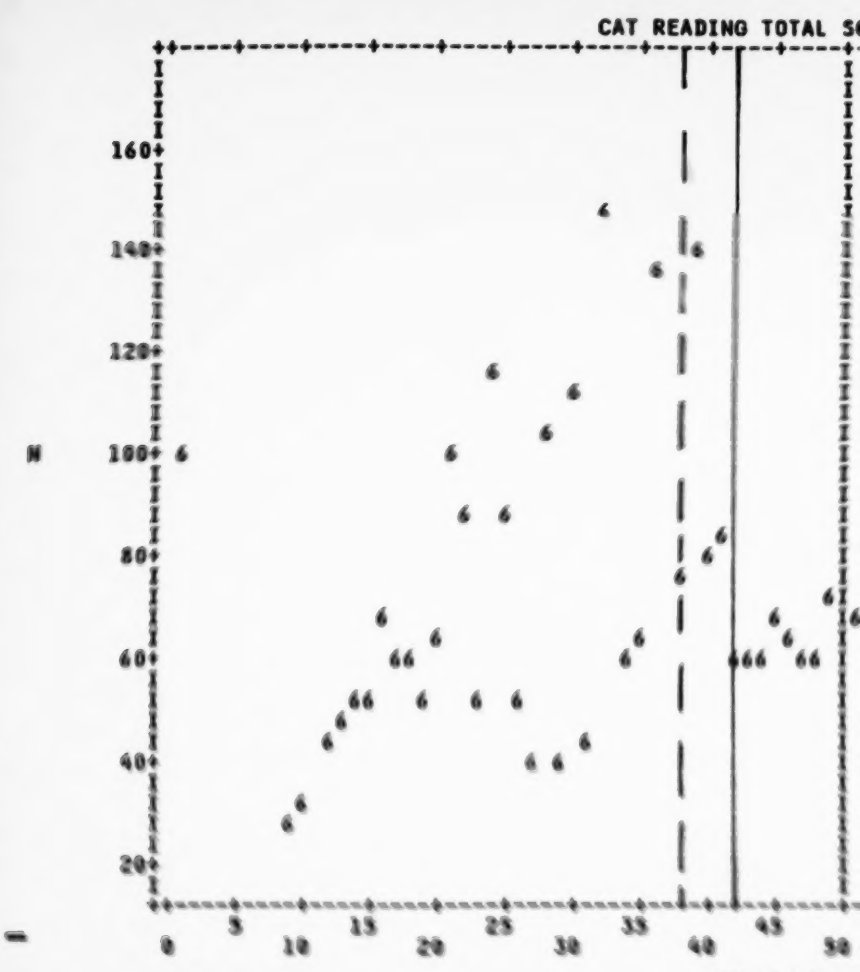
41 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0 F

N SCORE DISTRIBUTIONS



RCENTILE

R MULTIPLE OCCURRENCE.



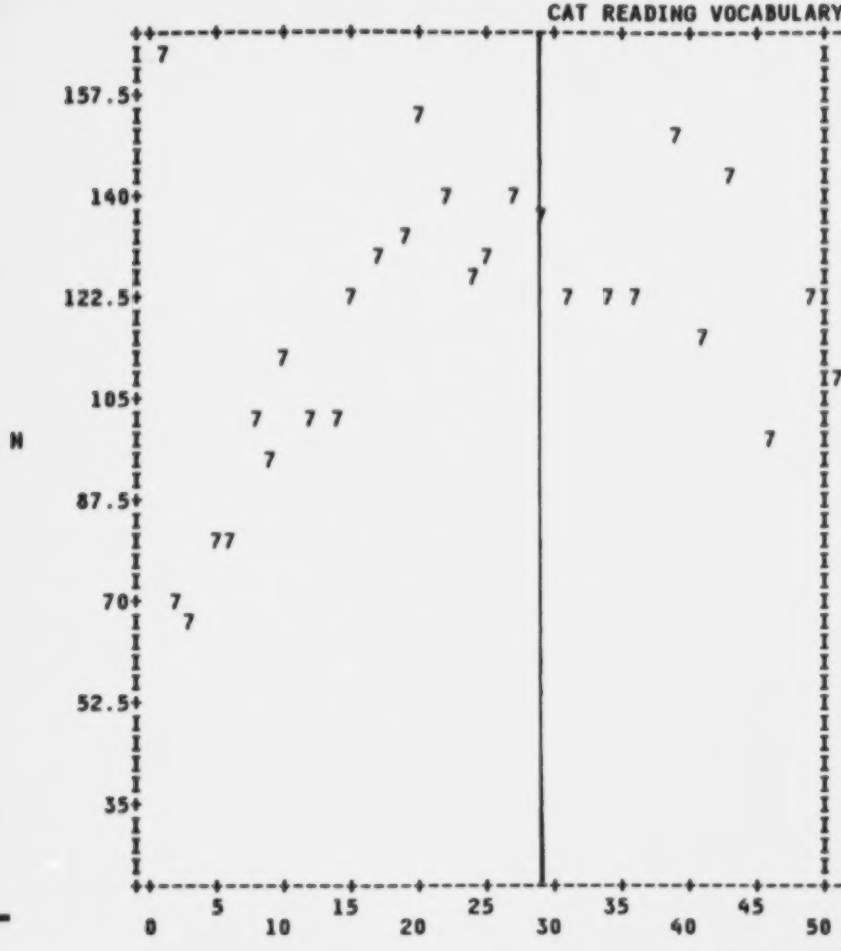
66 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0 FO

CORE DISTRIBUTIONS

RCENTILE

R MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:51:35 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



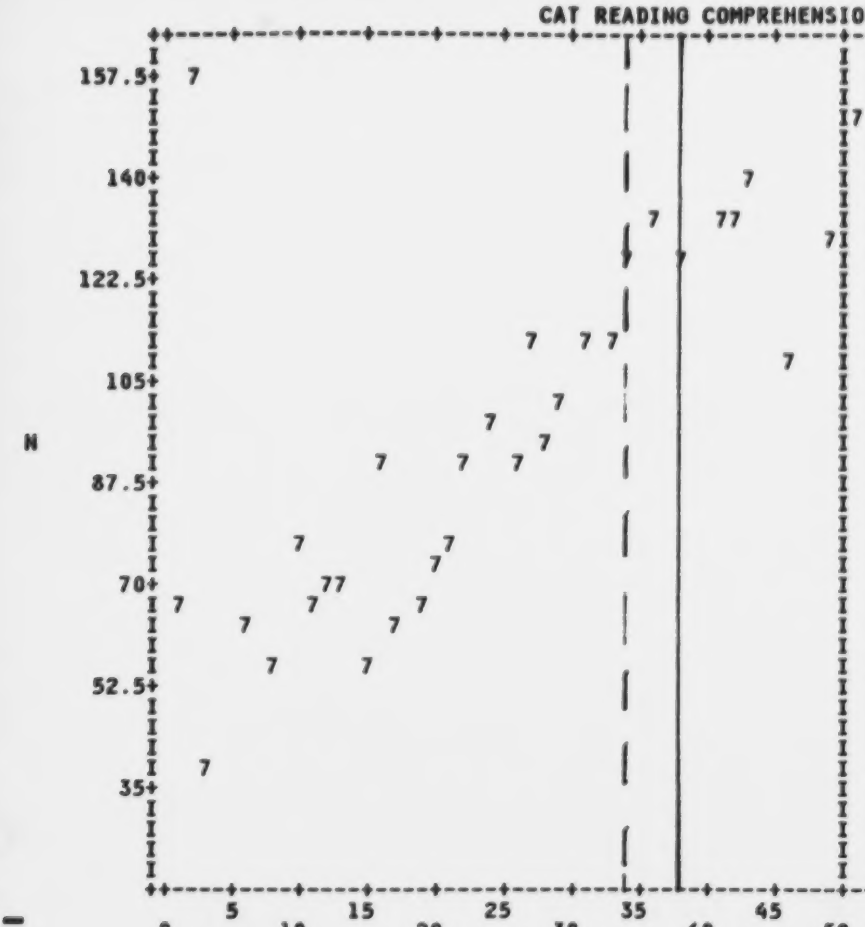
42 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0 FO

SCORE DISTRIBUTIONS

RCENTILE

R MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:47:13 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY

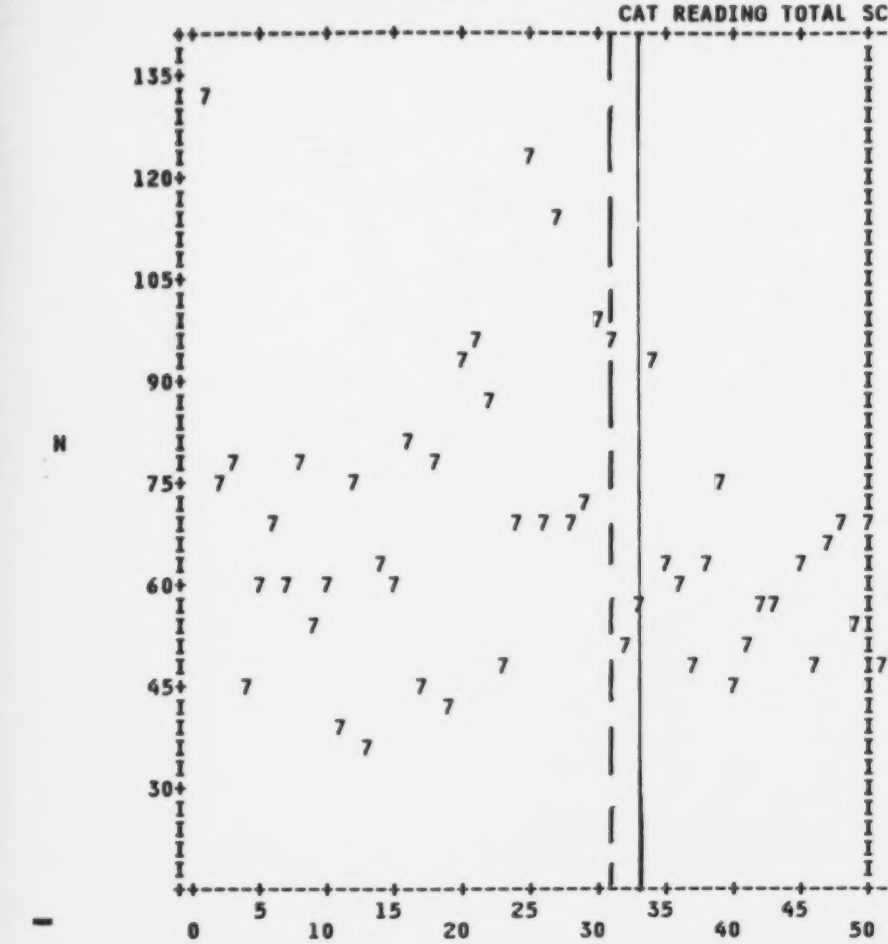


43 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0 FO

SCORE DISTRIBUTIONS

RCENTILE

R MULTIPLE OCCURRENCE.



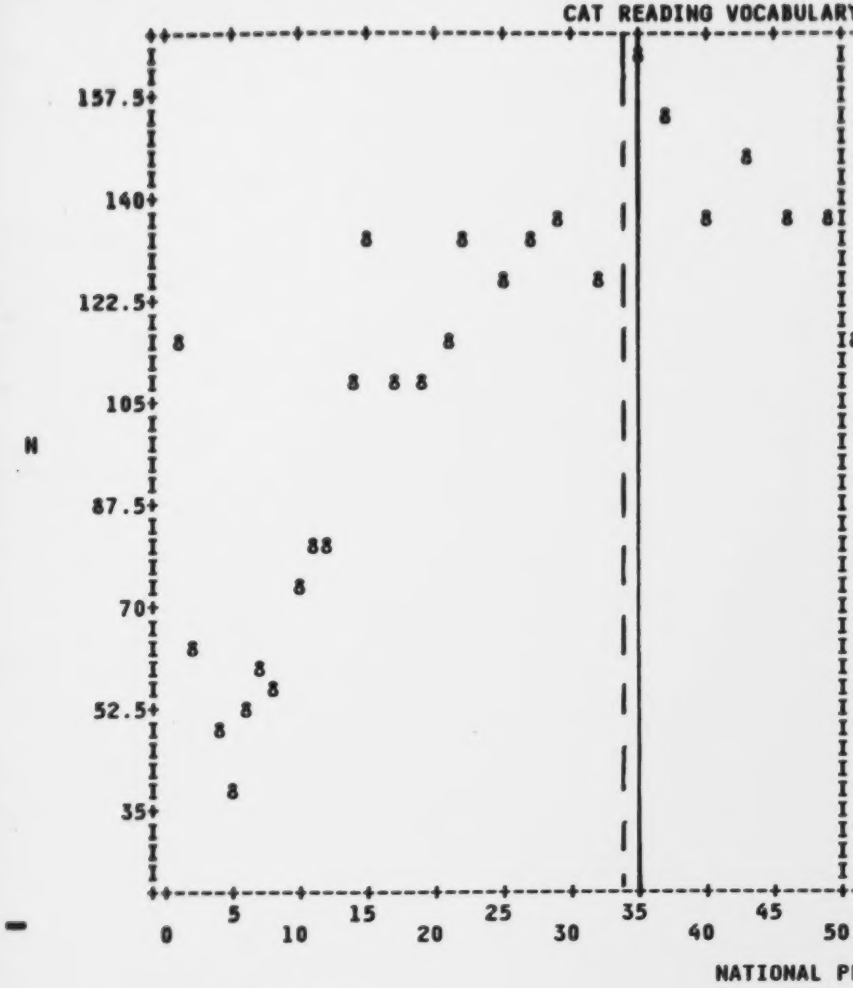
72 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND ♦ FO

ORE DISTRIBUTIONS

RCENTILE

R MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:51:36 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY

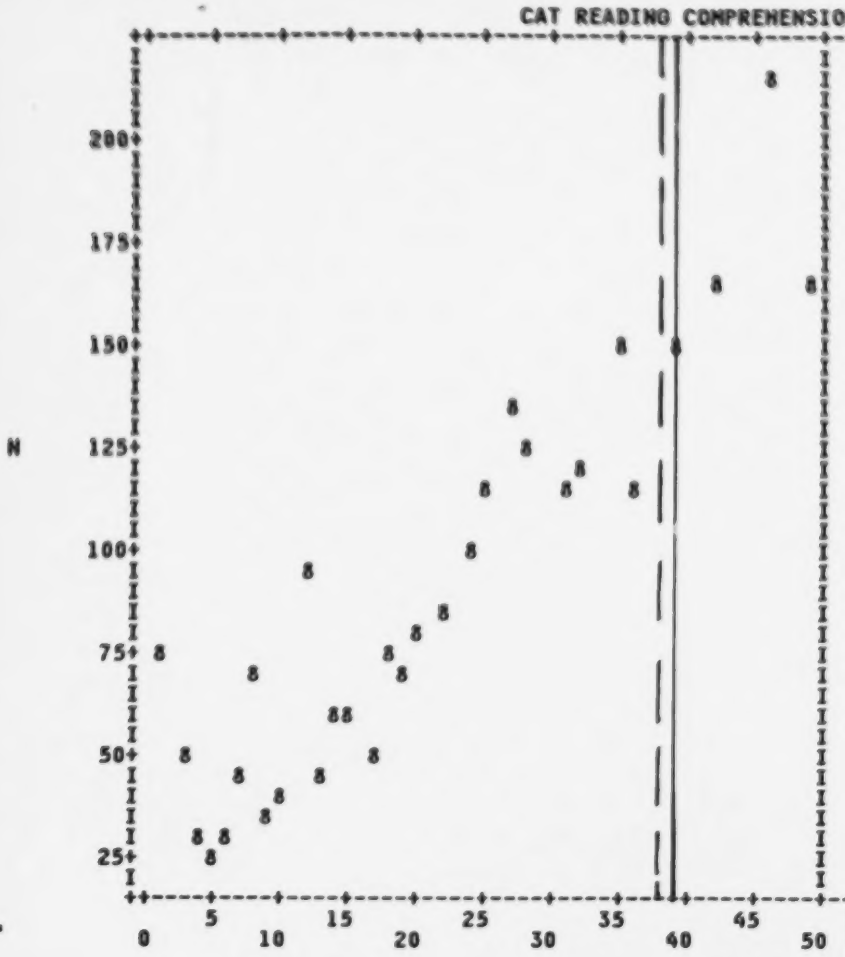


41 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND * F

SCORE DISTRIBUTIONS

ERCENTILE

OR MULTIPLE OCCURRENCE.



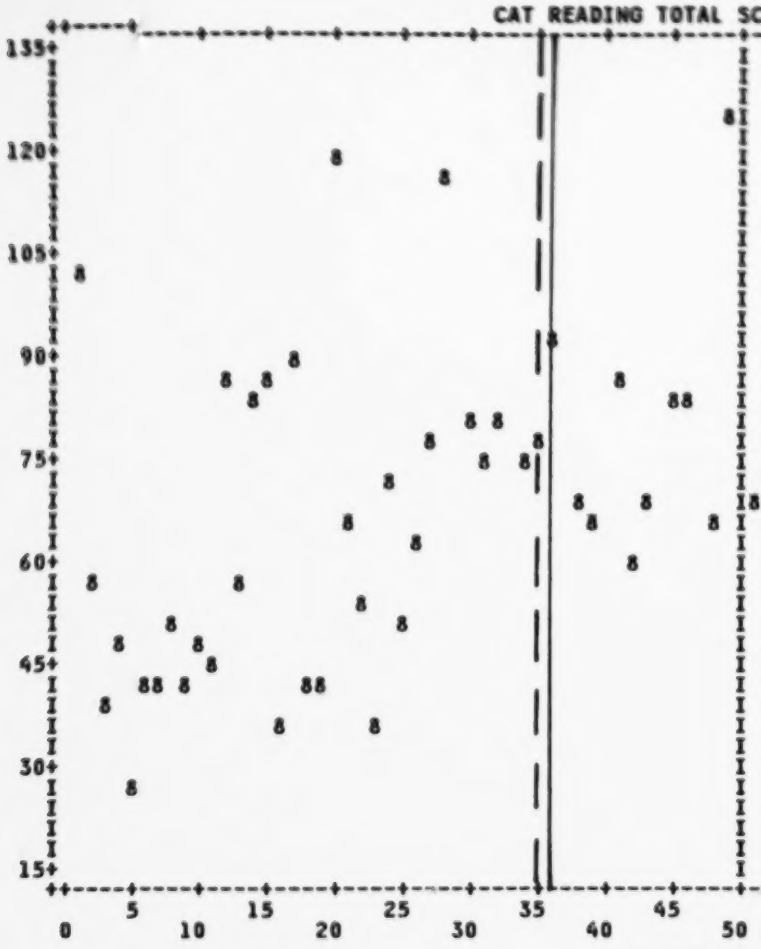
40 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0 FO

SCORE DISTRIBUTIONS

CENTILE

MULTIPLE OCCURRENCE.

14 FEB 90 SPSS 20--SPRING READING TEST SUMMARY
14:46:08 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



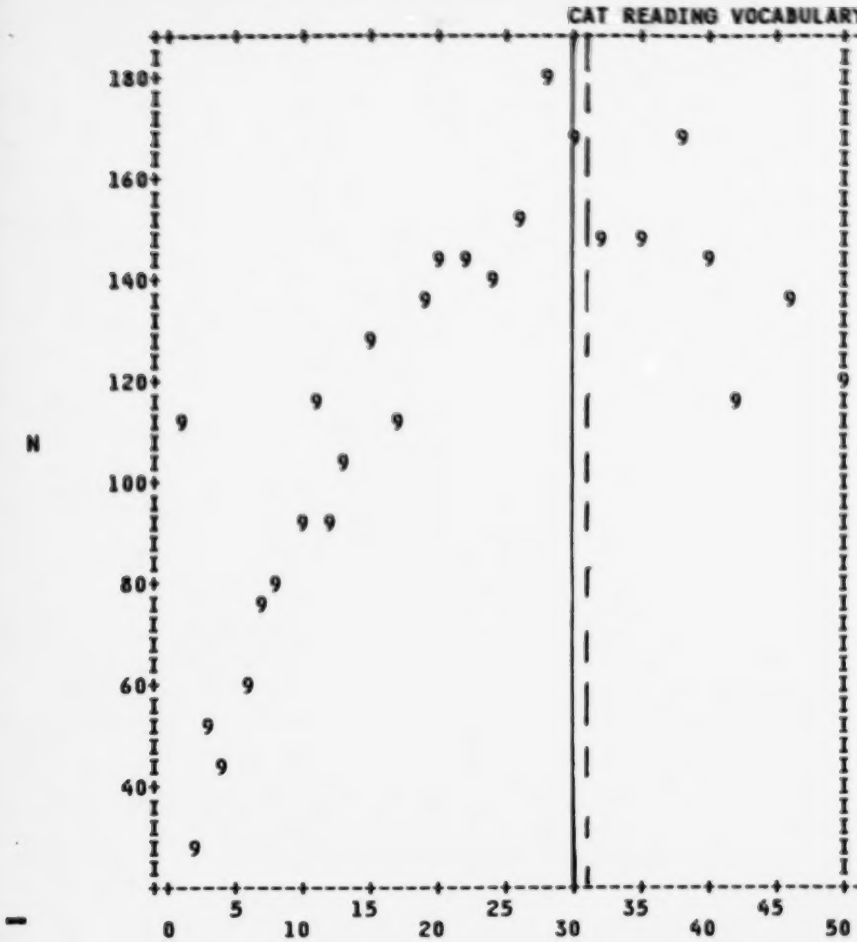
67 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0 FO

ORE DISTRIBUTIONS

RCENTILE

R MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:51:36 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



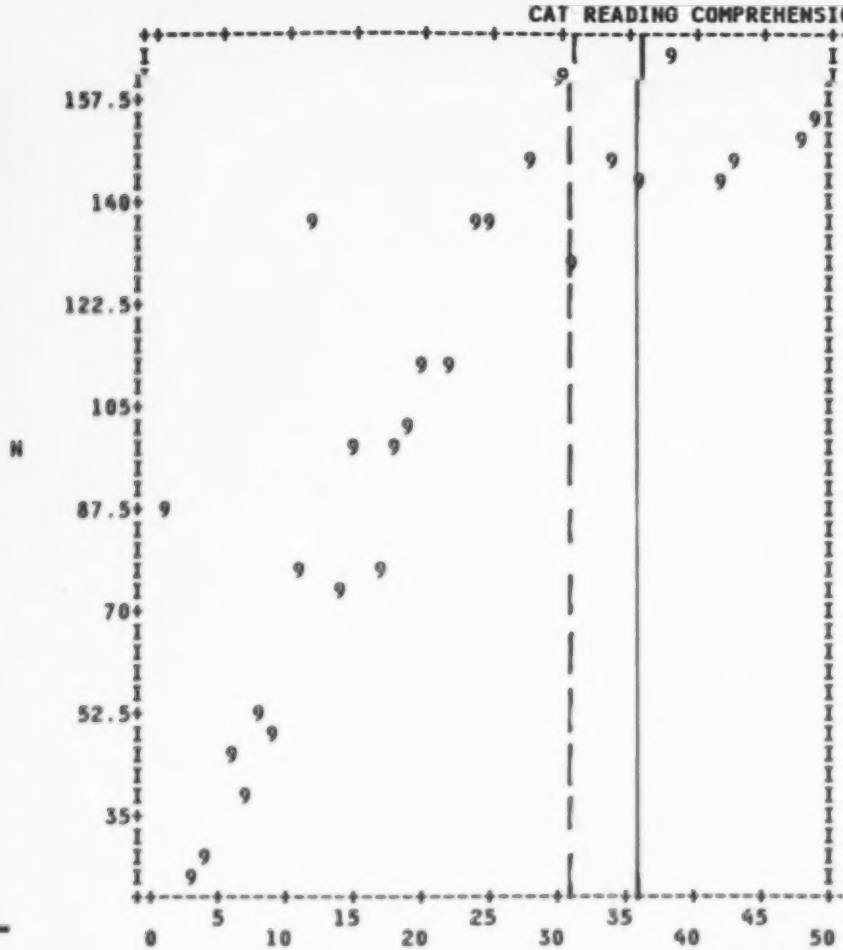
41 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0 FO

SCORE DISTRIBUTIONS

RCENTILE

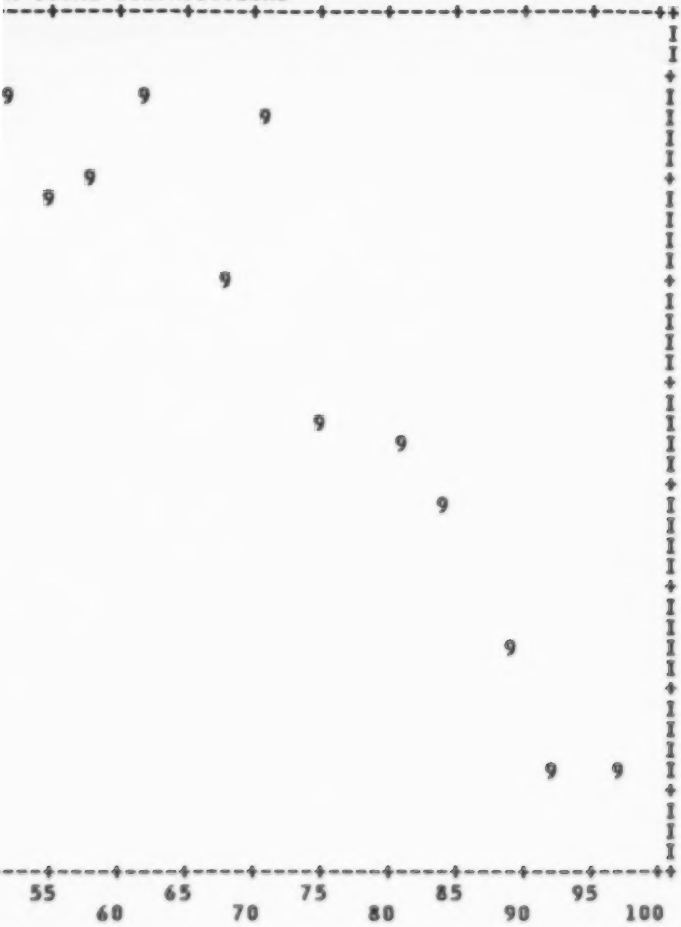
R MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:47:13 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



40 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0 FO

N SCORE DISTRIBUTIONS



RCENTILE

R MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
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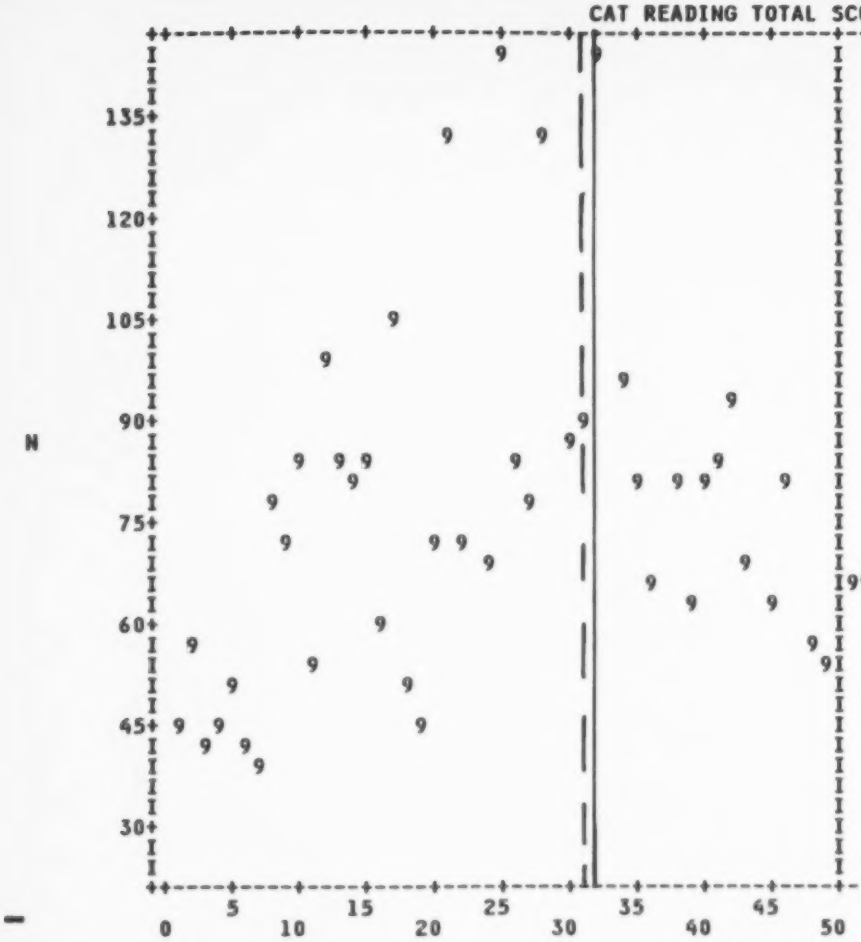
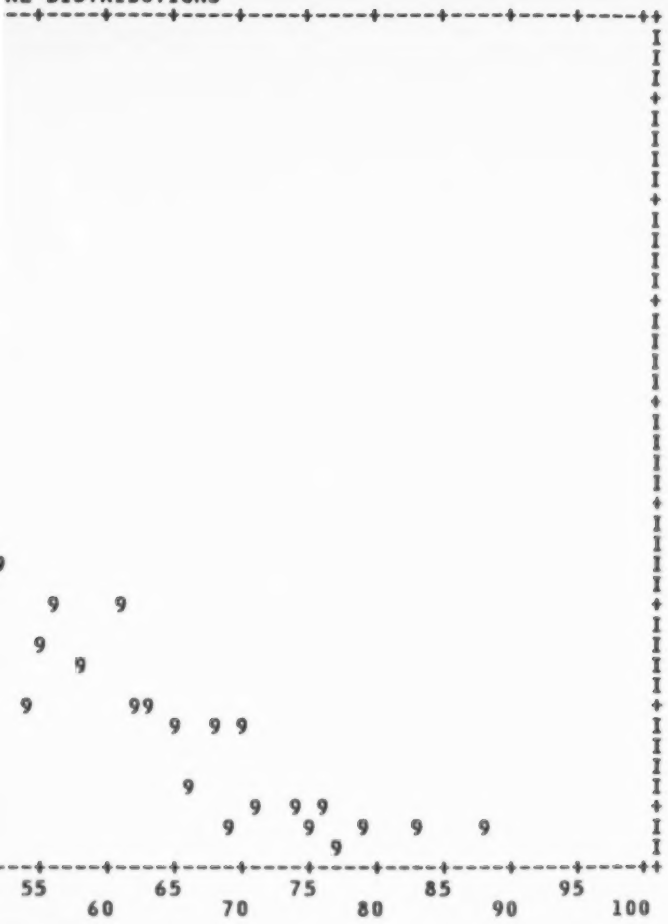


65 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $ FO

RE DISTRIBUTIONS



RCENTILE

R MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
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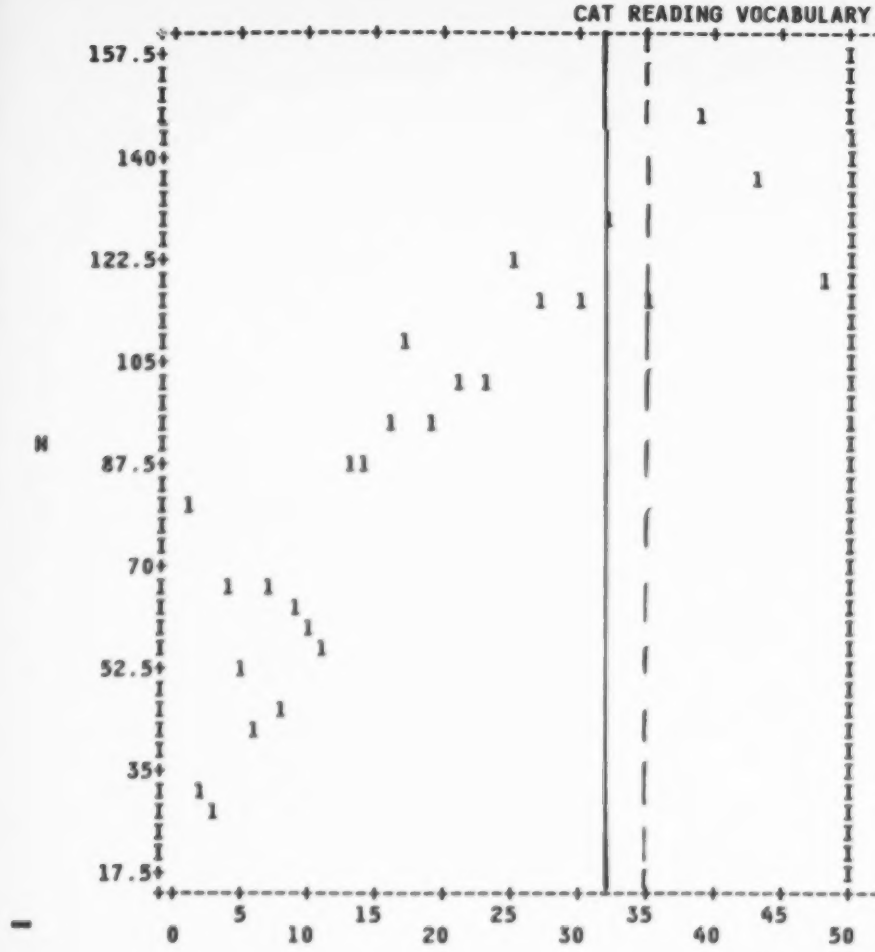

40 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0 FO

SCORE DISTRIBUTIONS

CENTILE

MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
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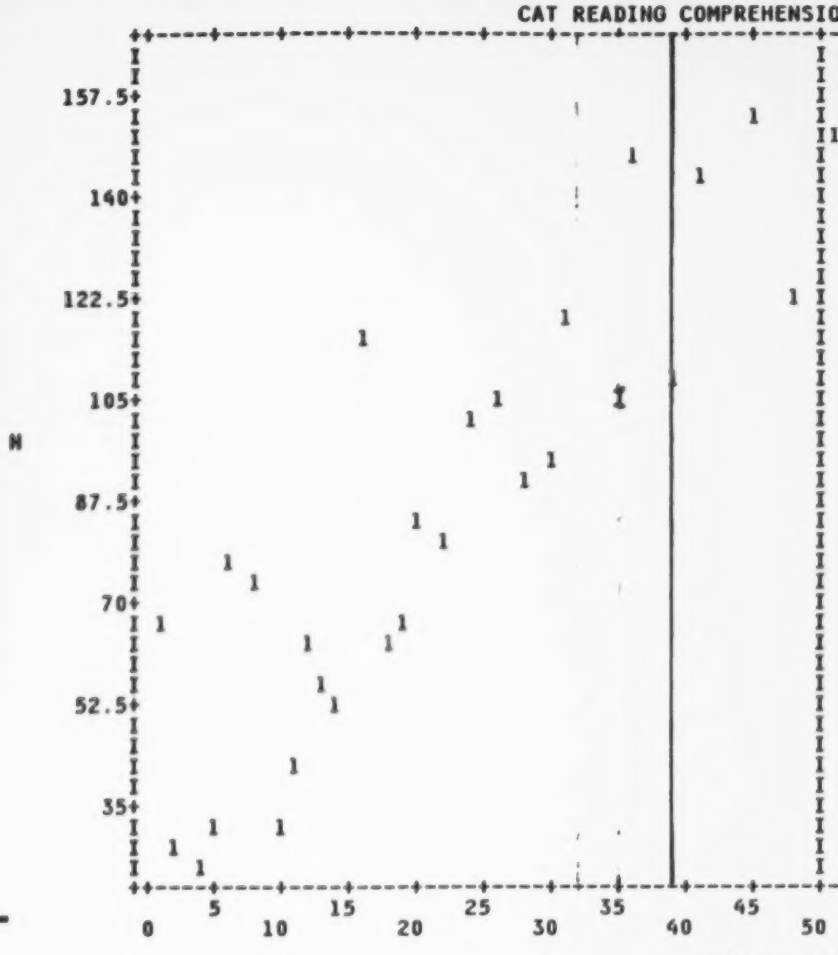


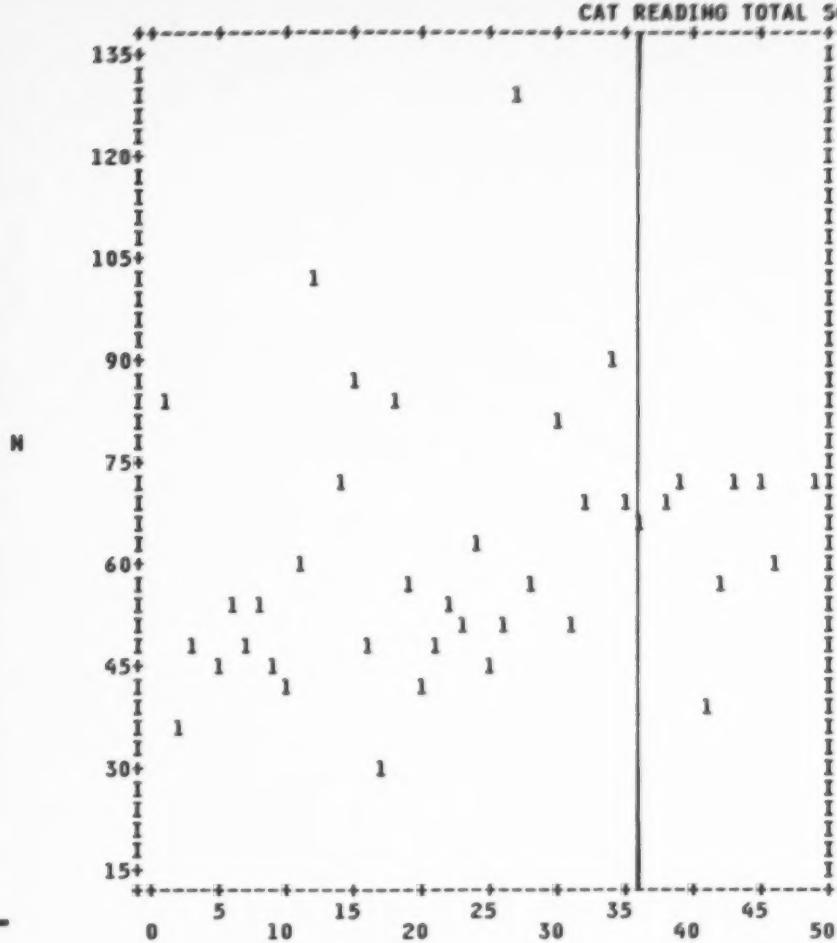
38 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0 FO

N SCORE DISTRIBUTIONS

RCENTILE

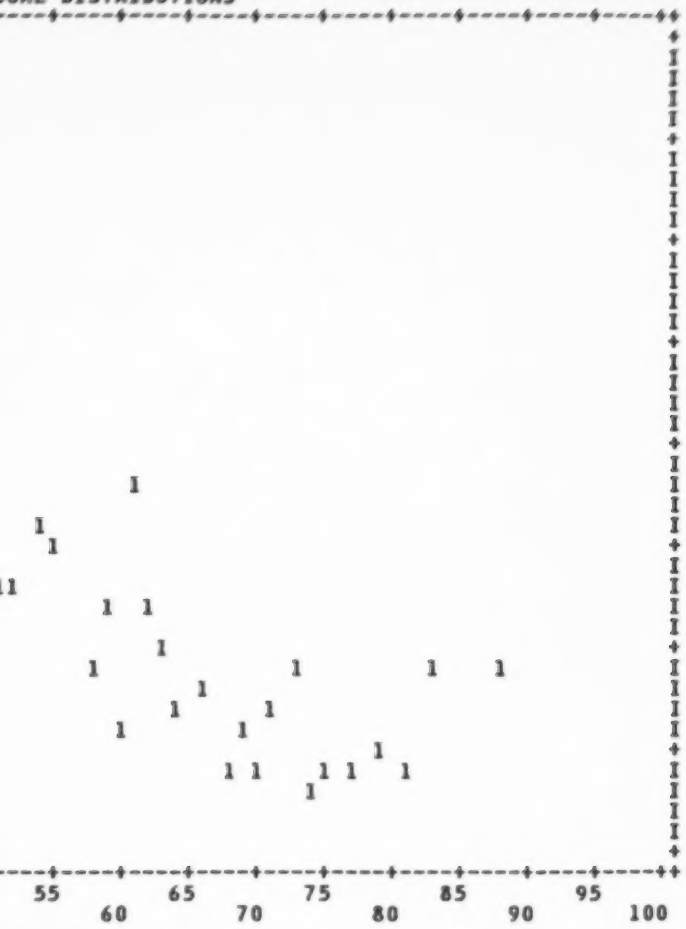
R MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:46:09 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



64 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $ F

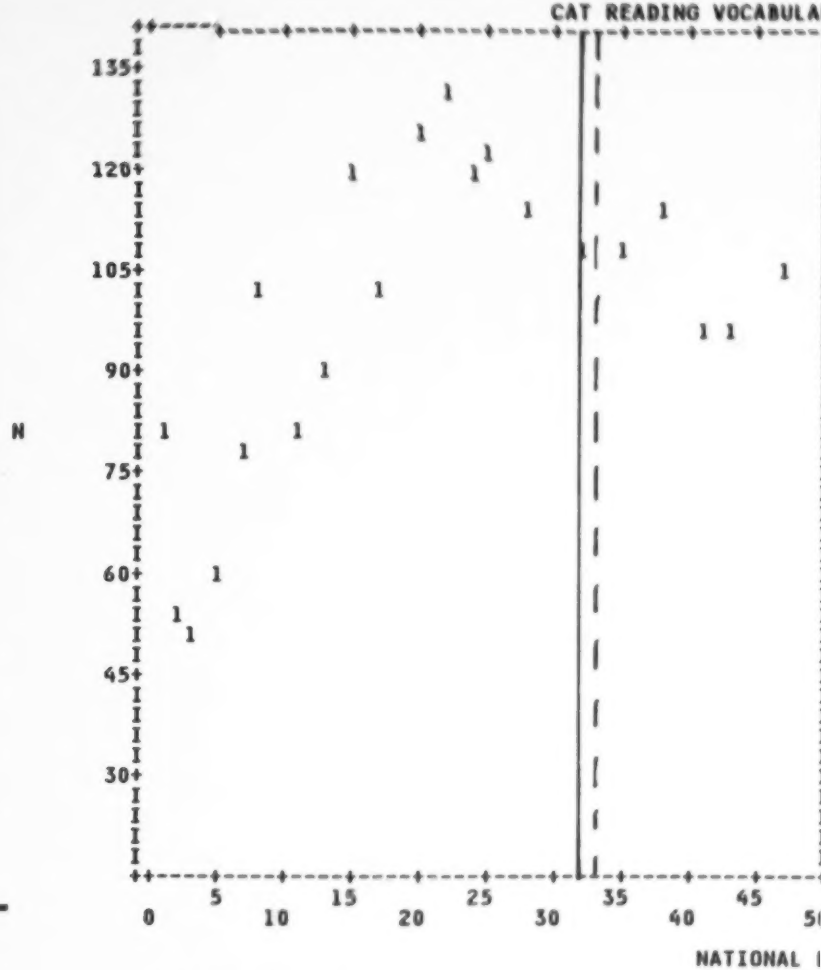
CORE DISTRIBUTIONS



ERCENTILE

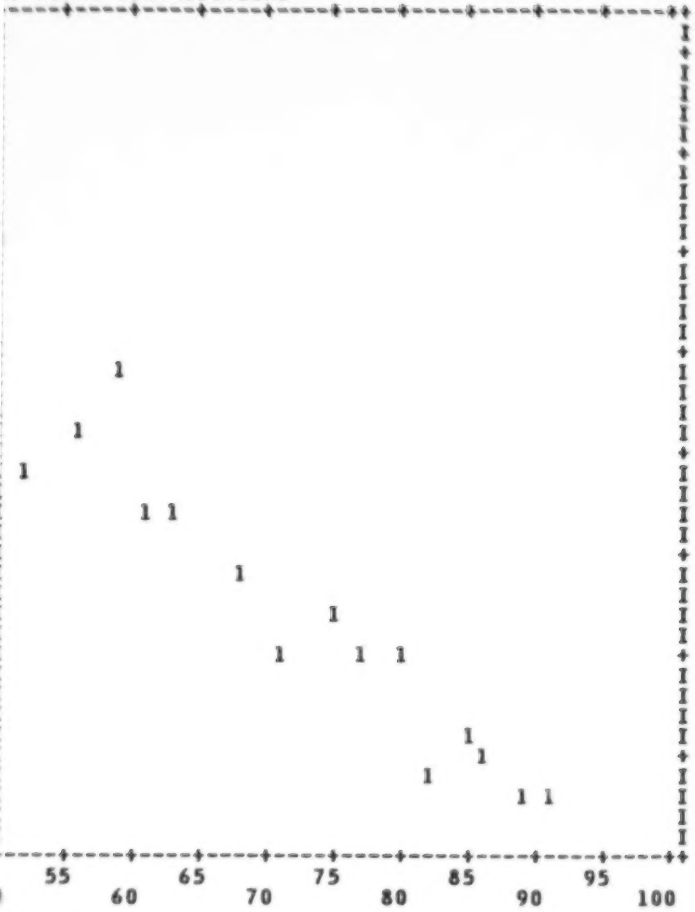
OR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:51:37 1985 SPRING CLEVELAND TESTING PROGRAM SUMMARY



37 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $

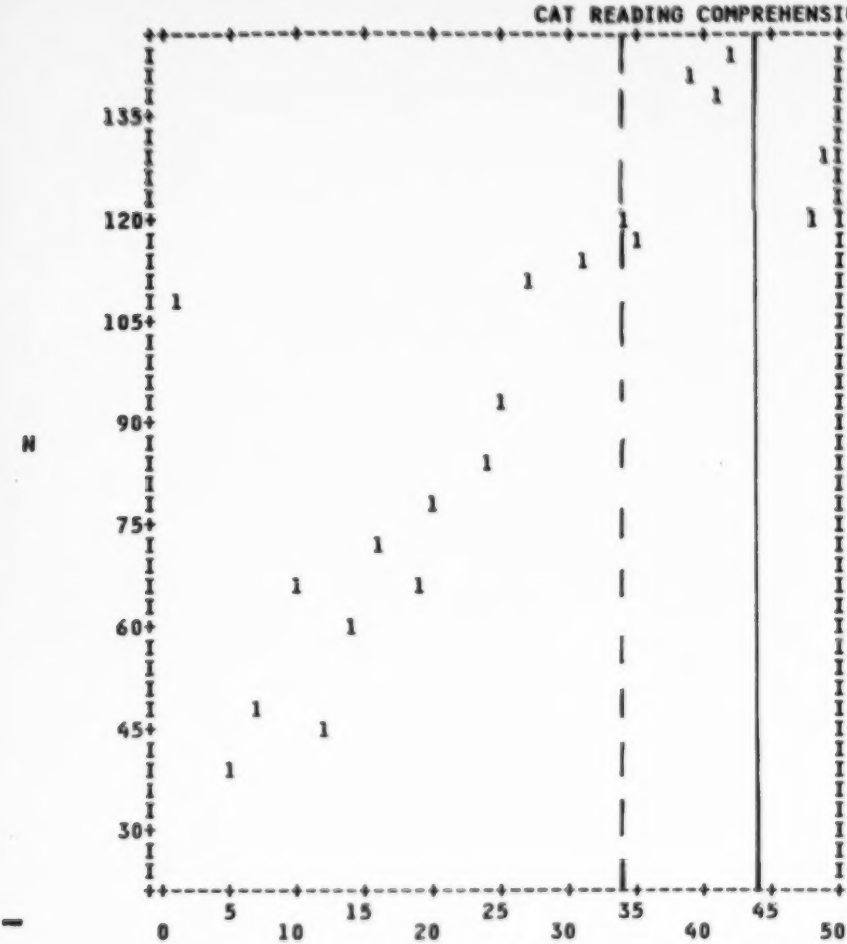
Y SCORE DISTRIBUTIONS



ERCENTILE

OR MULTIPLE OCCURRENCE.

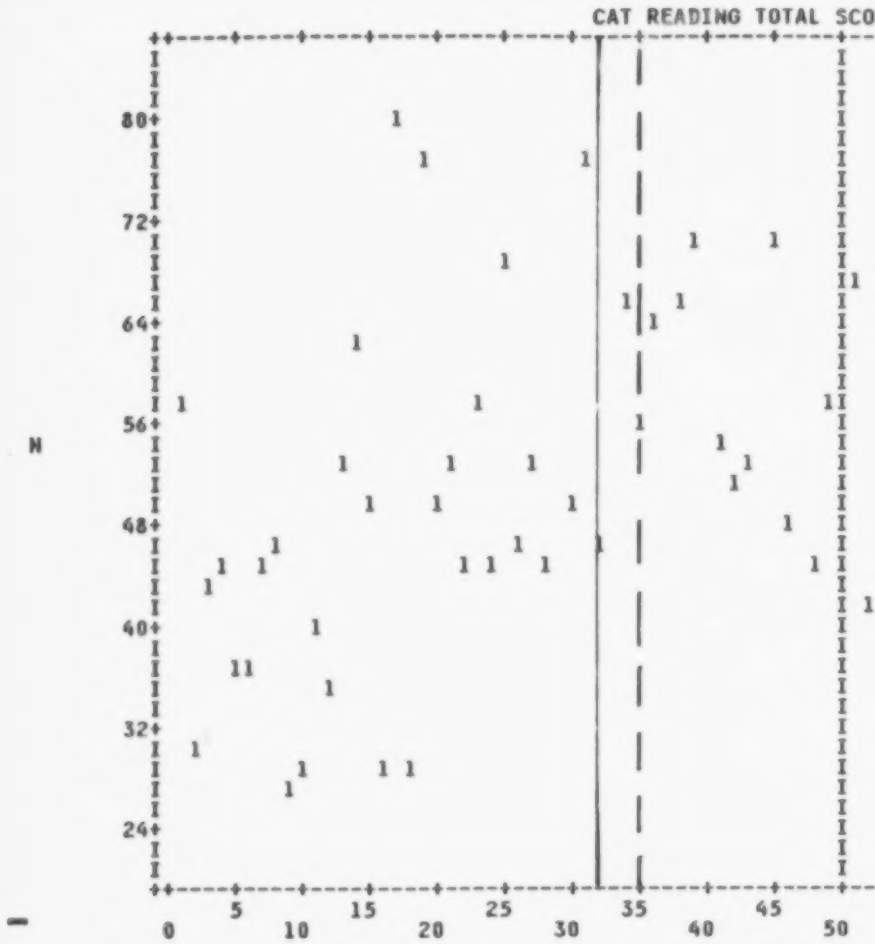
14 FEB 90 SPSS20--SPRING READING TEST SUMMARY
14:47:14 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



35 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND # F

IN SCORE DISTRIBUTIONS

1
1
1



59 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $ FOR

RE DISTRIBUTIONS

CENTILE

MULTIPLE OCCURRENCE.

1988 CAT Mathematics Test Plots

The plotted values represent aggregated frequencies fo percentile rank scores for pupils tested in each grades.

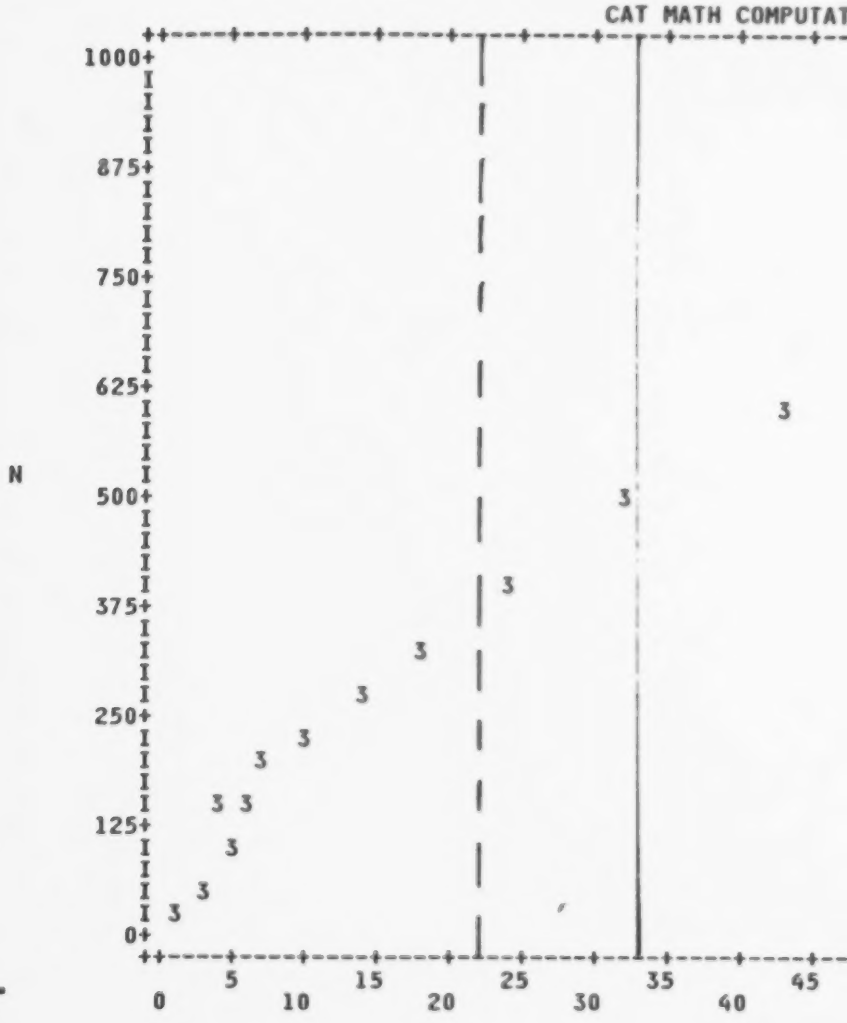
Legend: I - National Norm Median

| - Local Median per 1986 Norms

¦ - Local Median per 1988 NTD

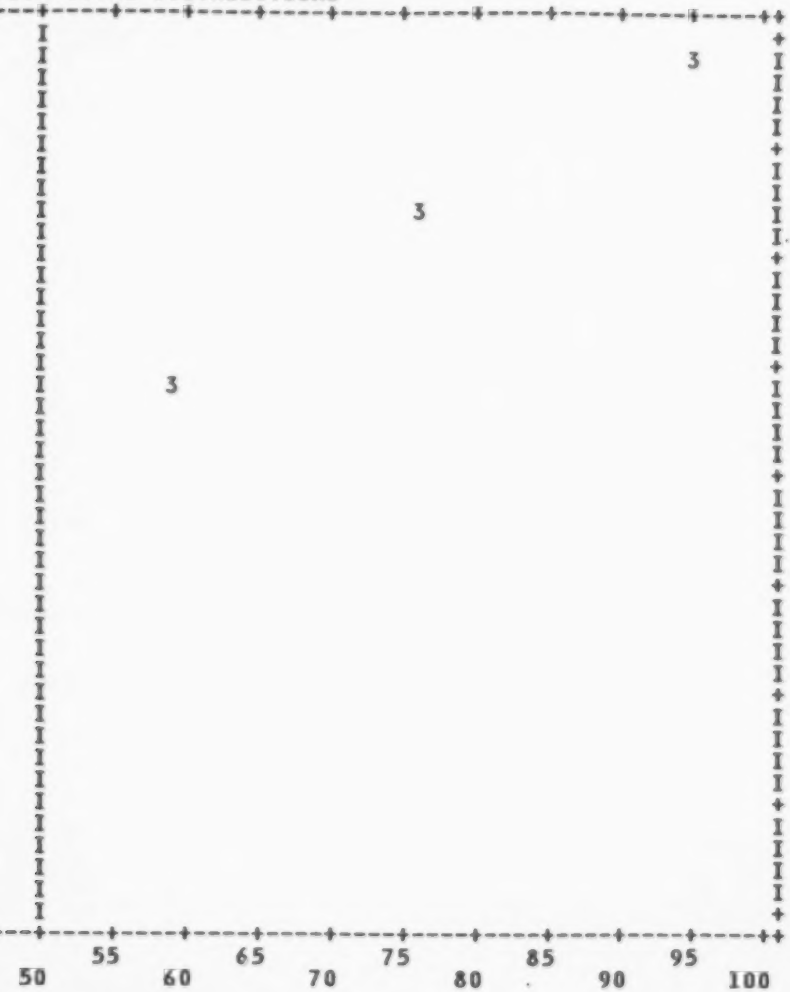
Note: Single solid line on the plot indicates '86 and NTD reference ranks are equal.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:49:23 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



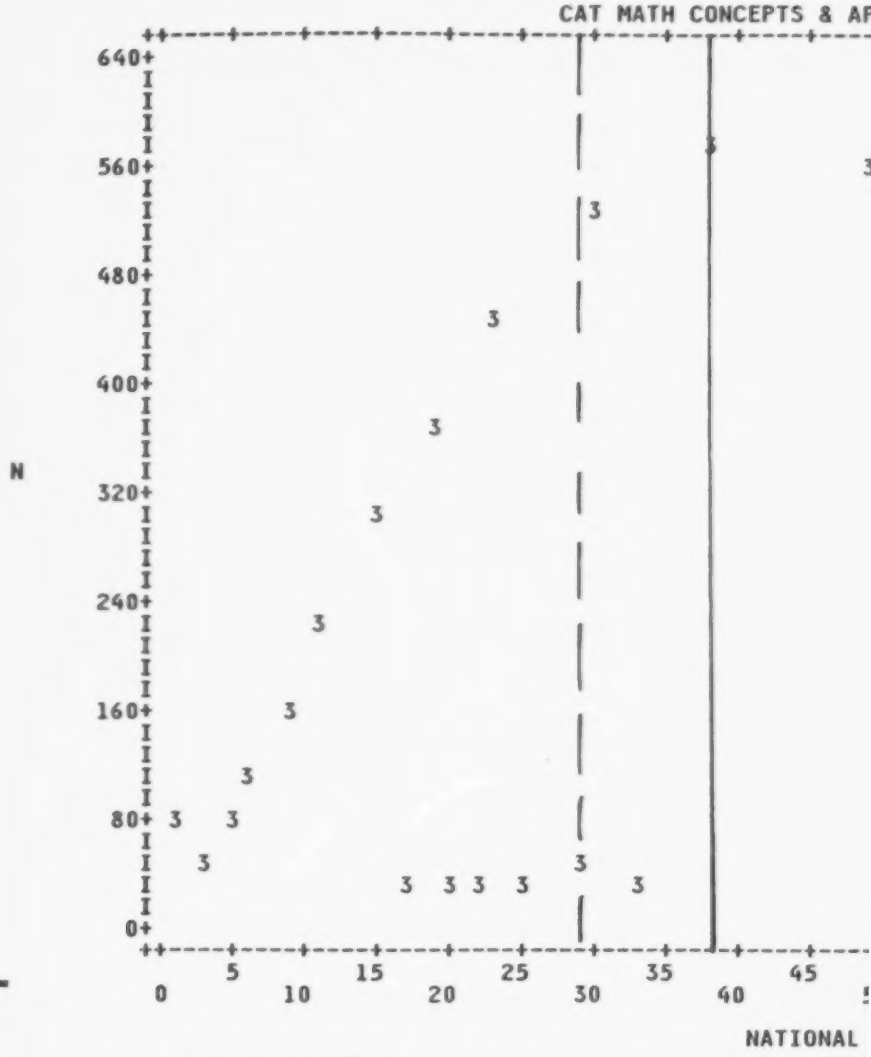
15 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND

TION SCORE DISTRIBUTIONS



L PERCENTILE

$ FOR MULTIPLE OCCURRENCE.

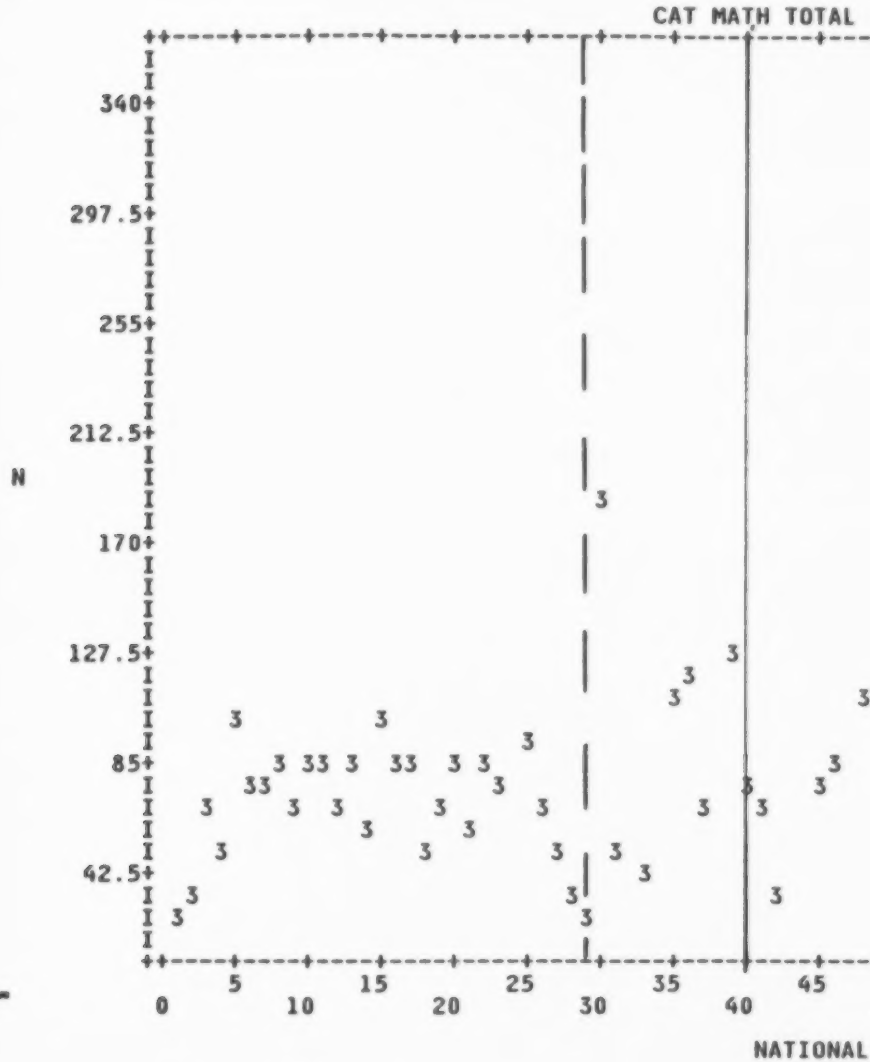


23 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $

PLNS SCORE DISTRIBUTIONS

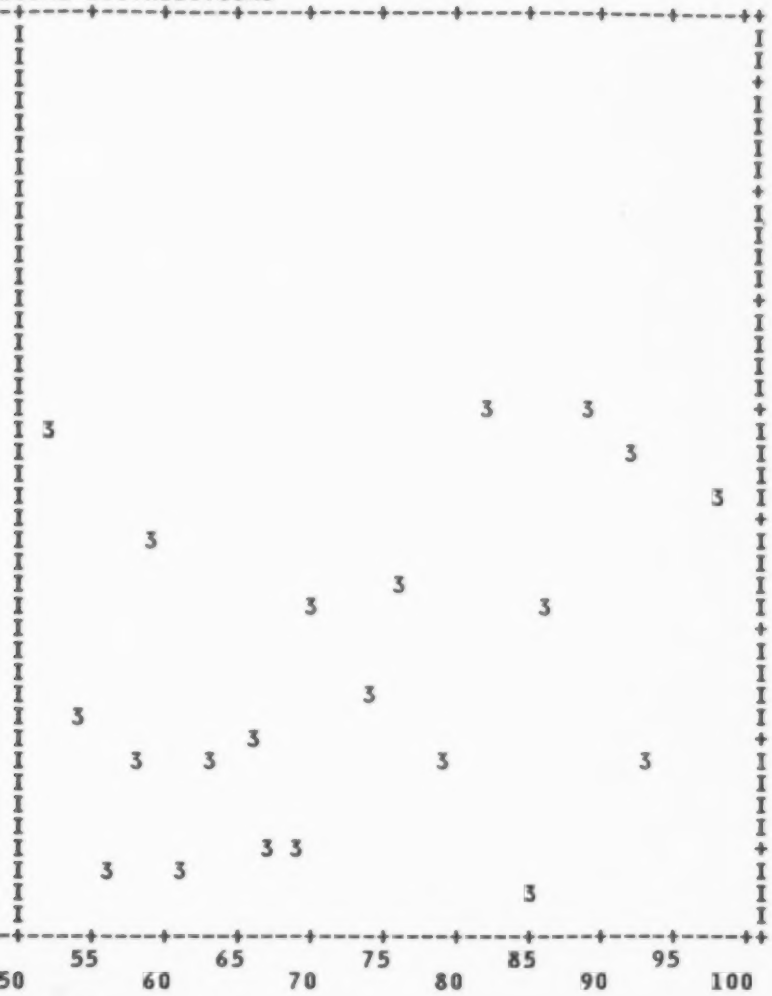
PERCENTILE

FOR MULTIPLE OCCURRENCE.

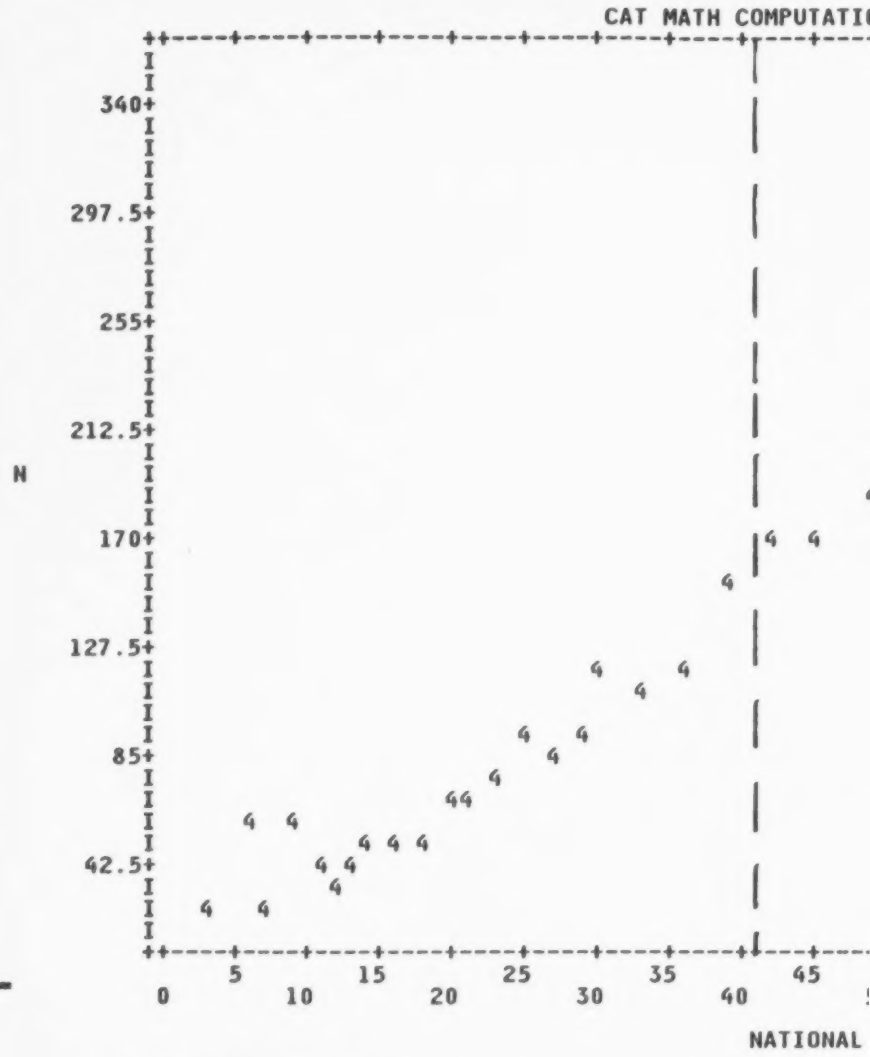


62 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $

SCORE DISTRIBUTIONS

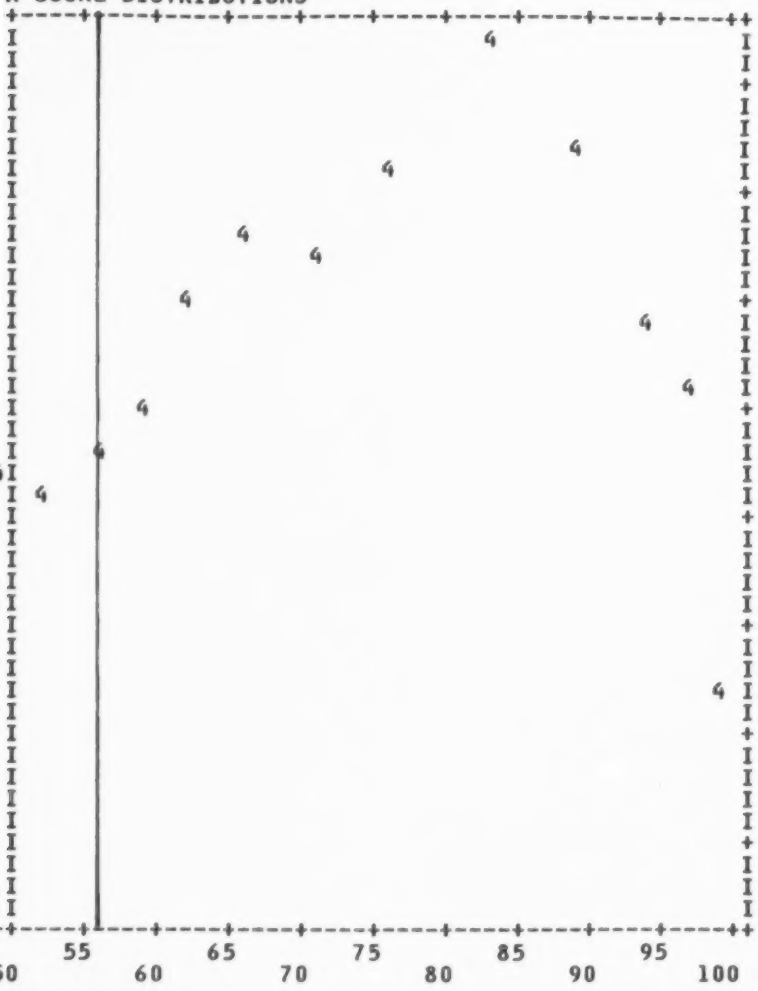


FOR MULTIPLE OCCURRENCE.



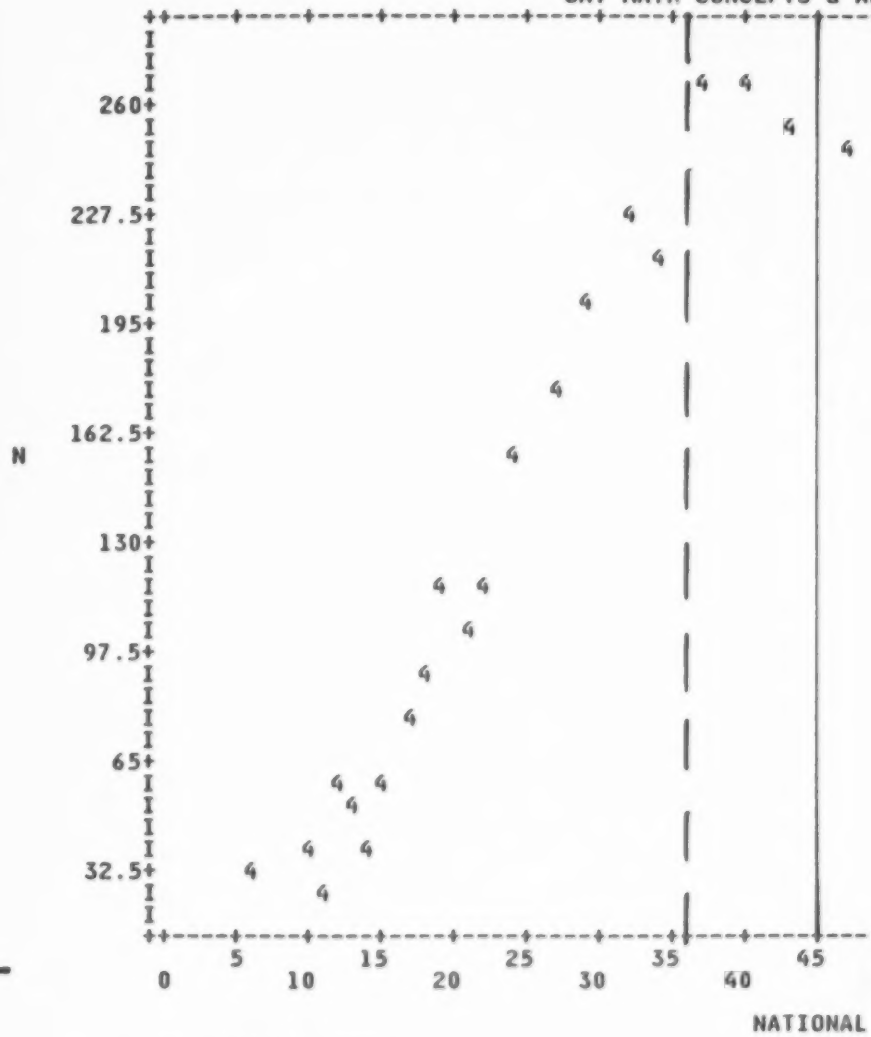
35 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $

N SCORE DISTRIBUTIONS



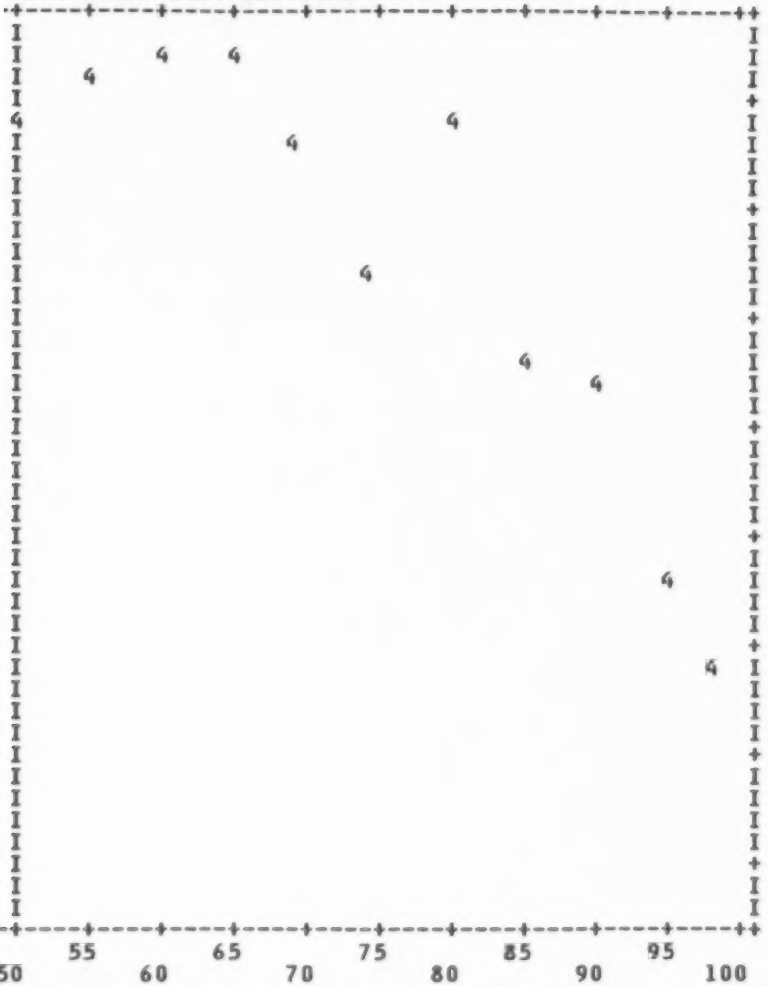
PERCENTILE

FOR MULTIPLE OCCURRENCE.



32 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $

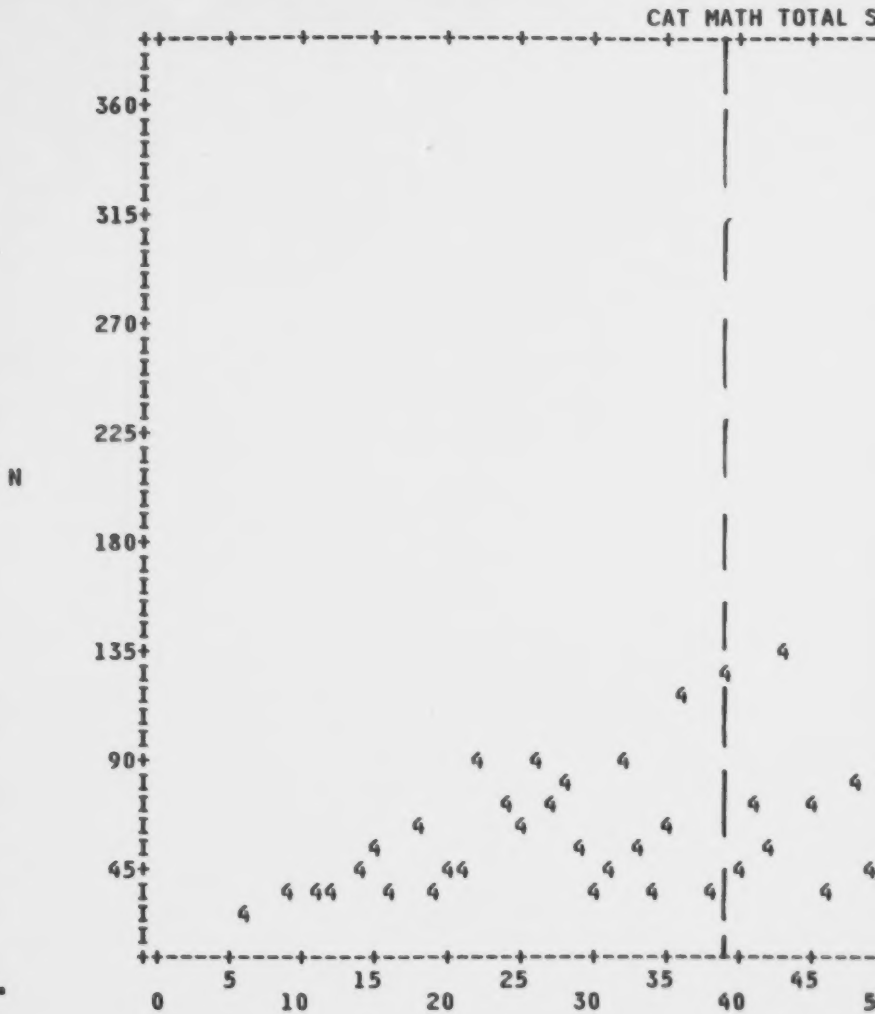
'PLNS SCORE DISTRIBUTIONS



PERCENTILE

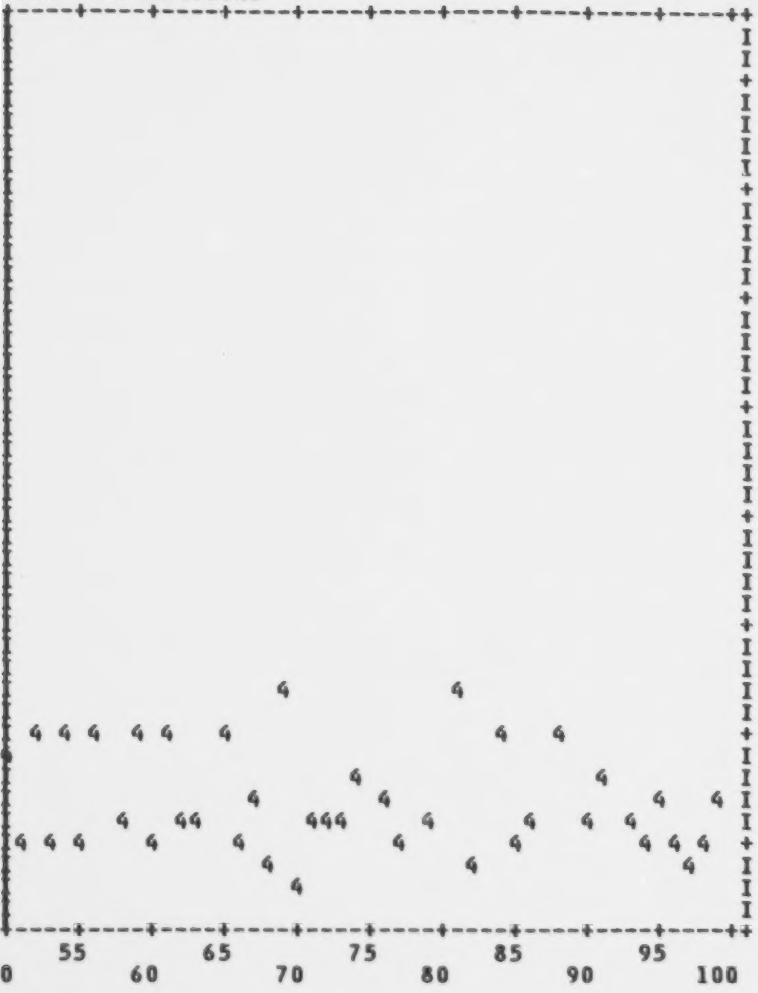
FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:48:18 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



76 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0

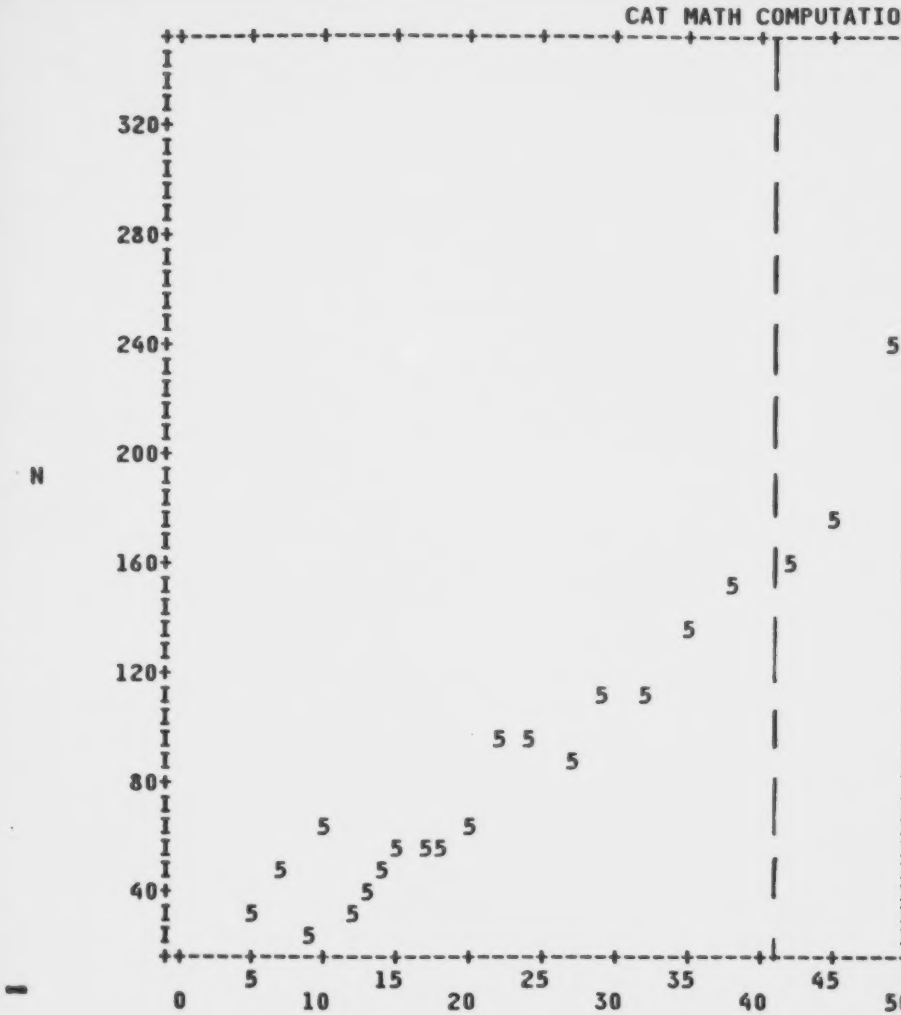
CORE DISTRIBUTIONS



PERCENTILE

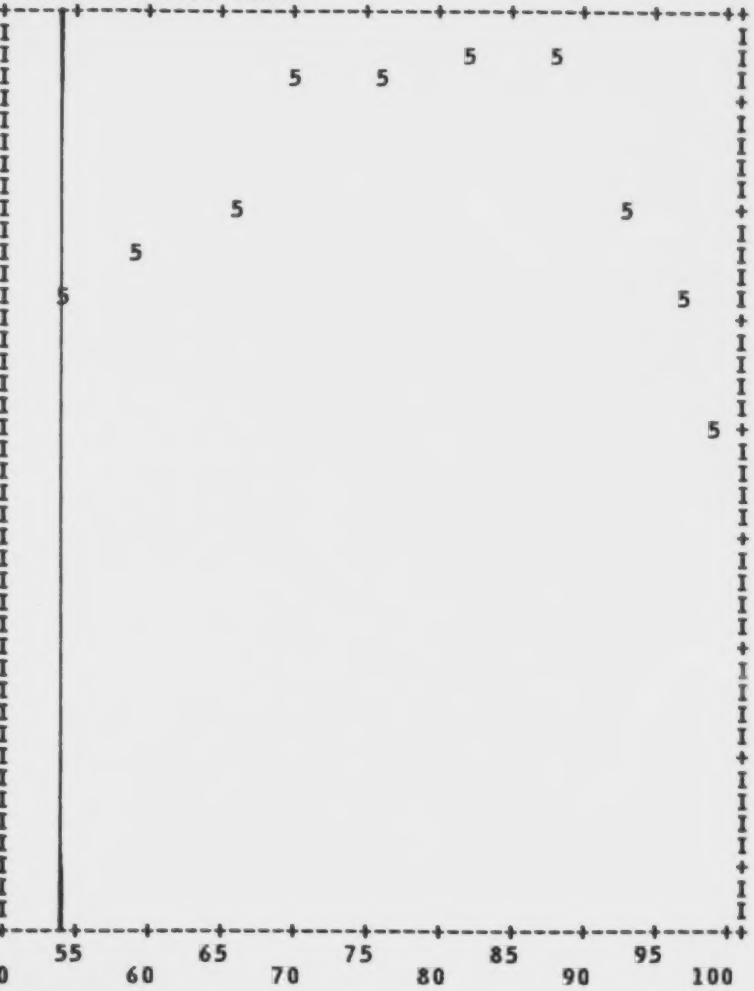
FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:49:24 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



31 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $

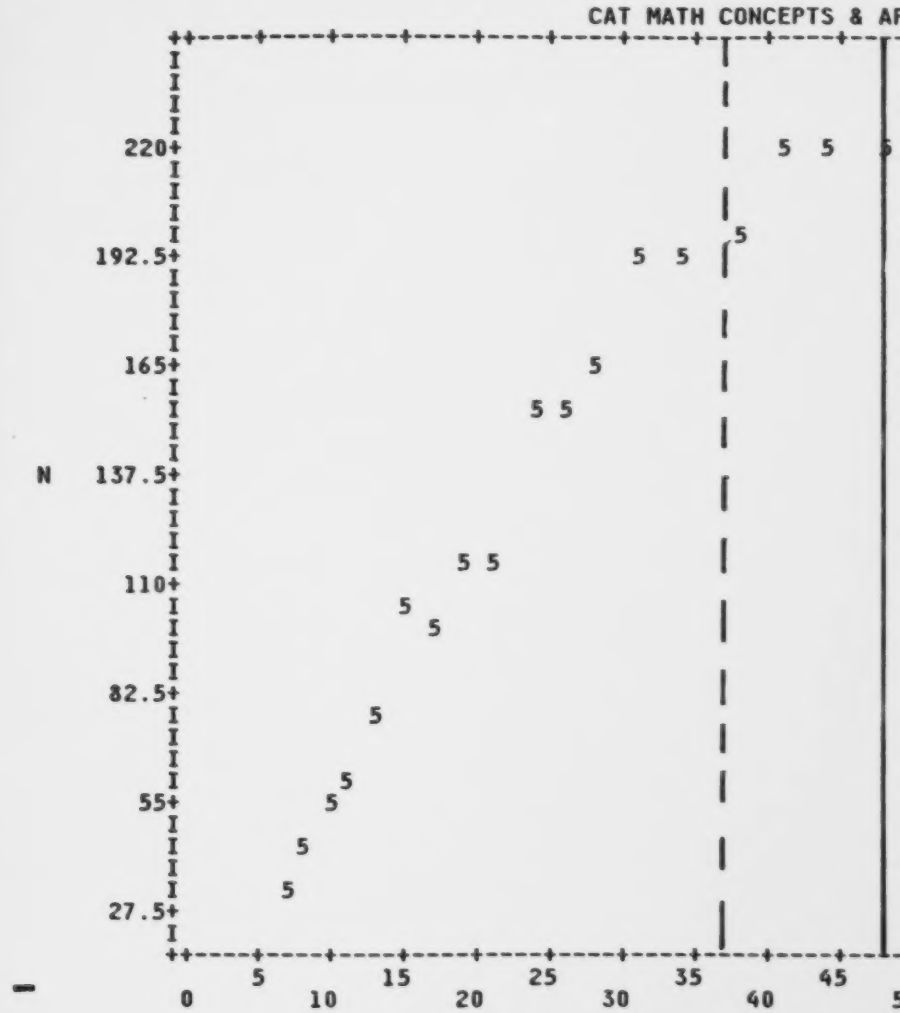
N SCORE DISTRIBUTIONS



PERCENTILE

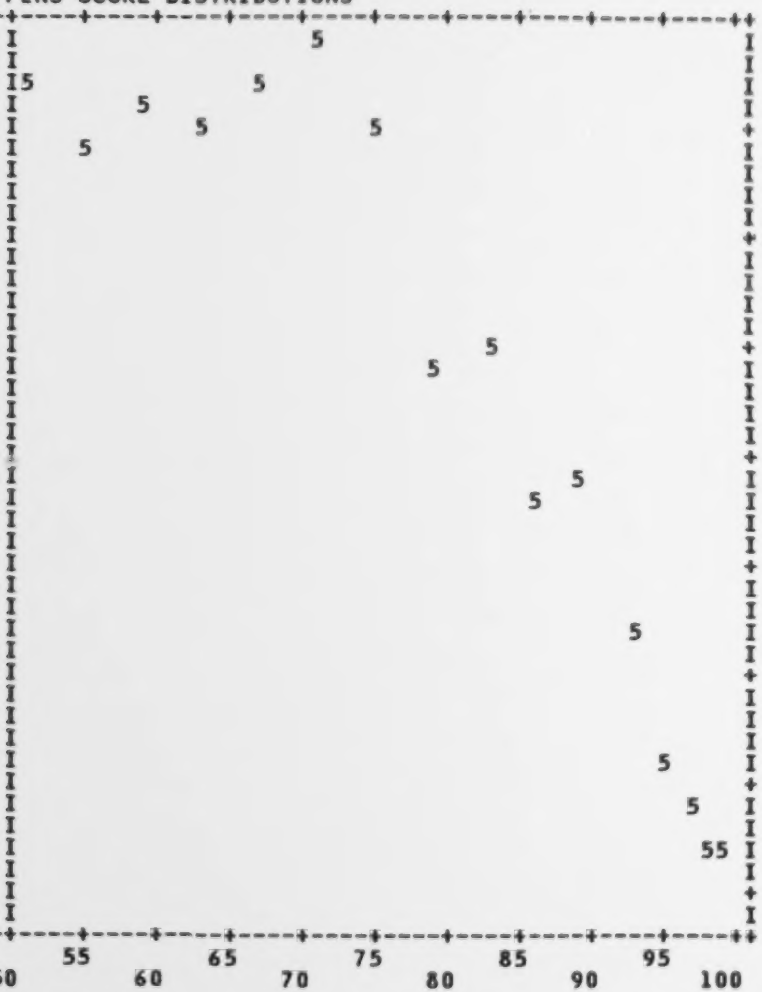
FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:50:29 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



34 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $

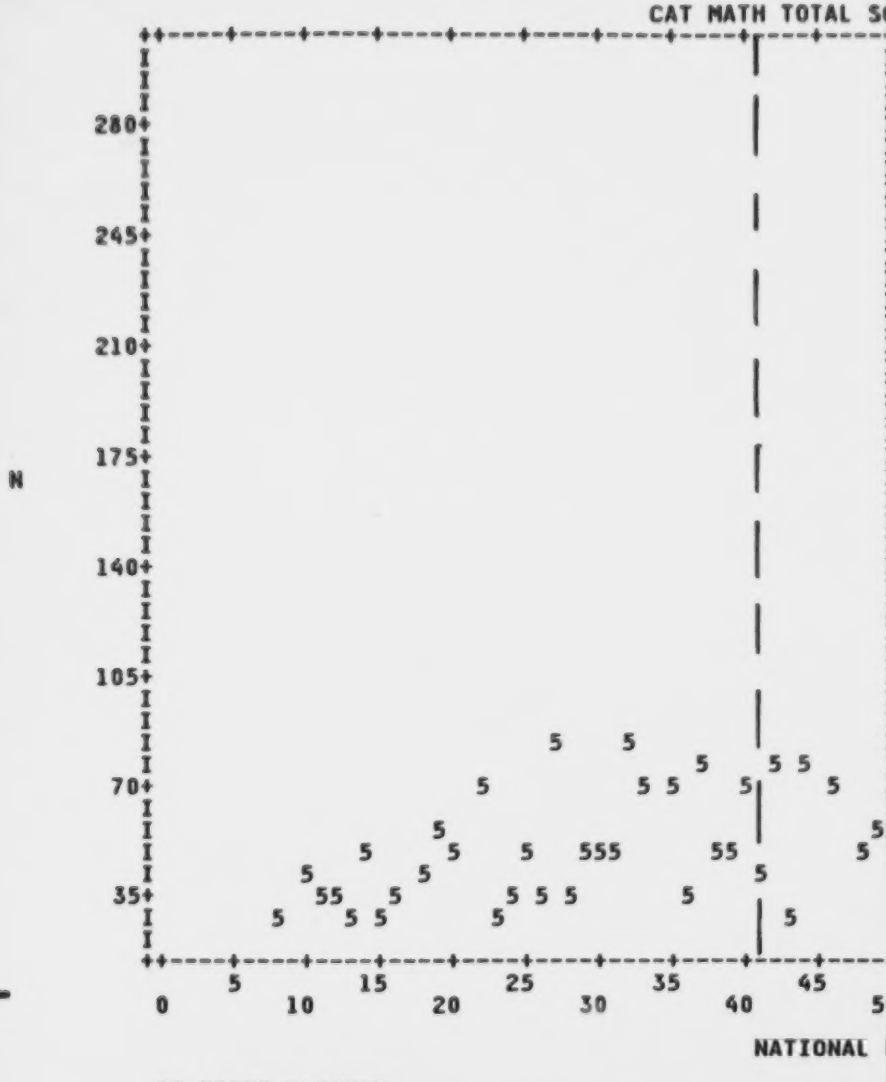
PPLNS SCORE DISTRIBUTIONS



PERCENTILE

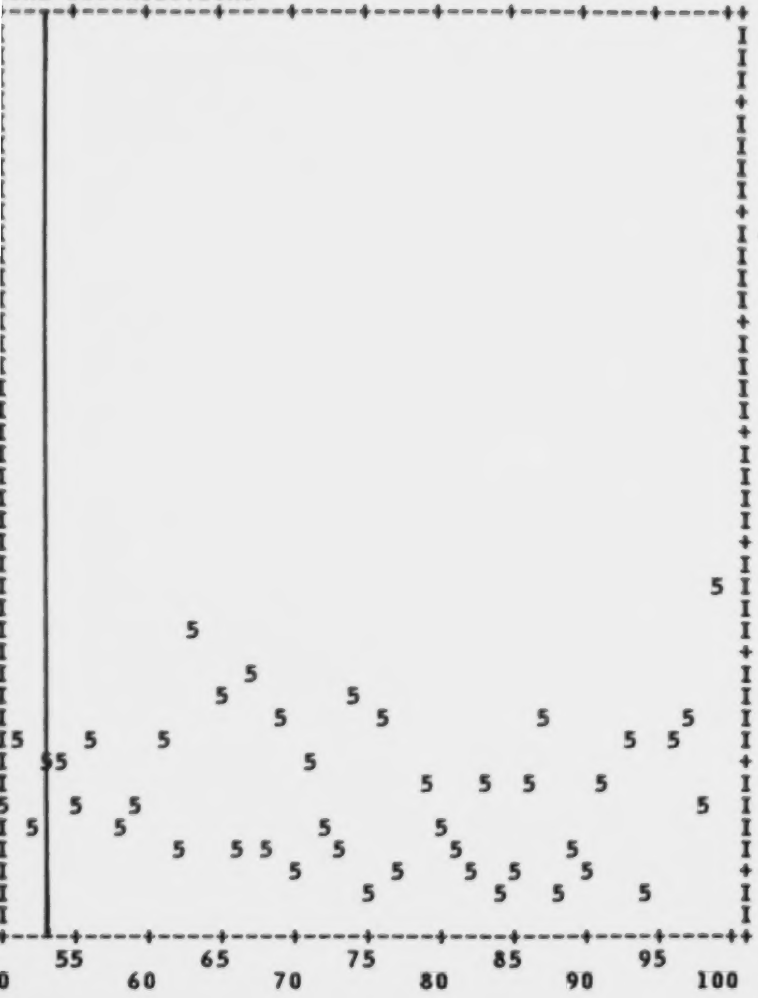
FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:48:19 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



80 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $

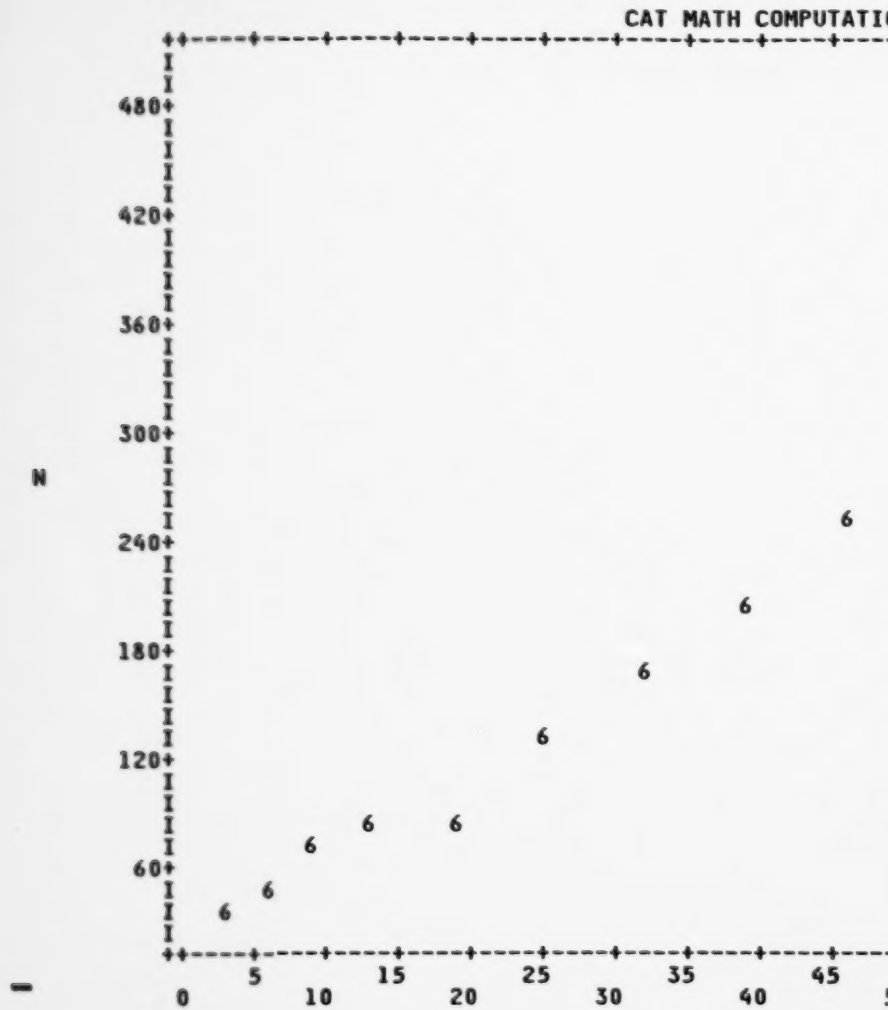
CORE DISTRIBUTIONS



PERCENTILE

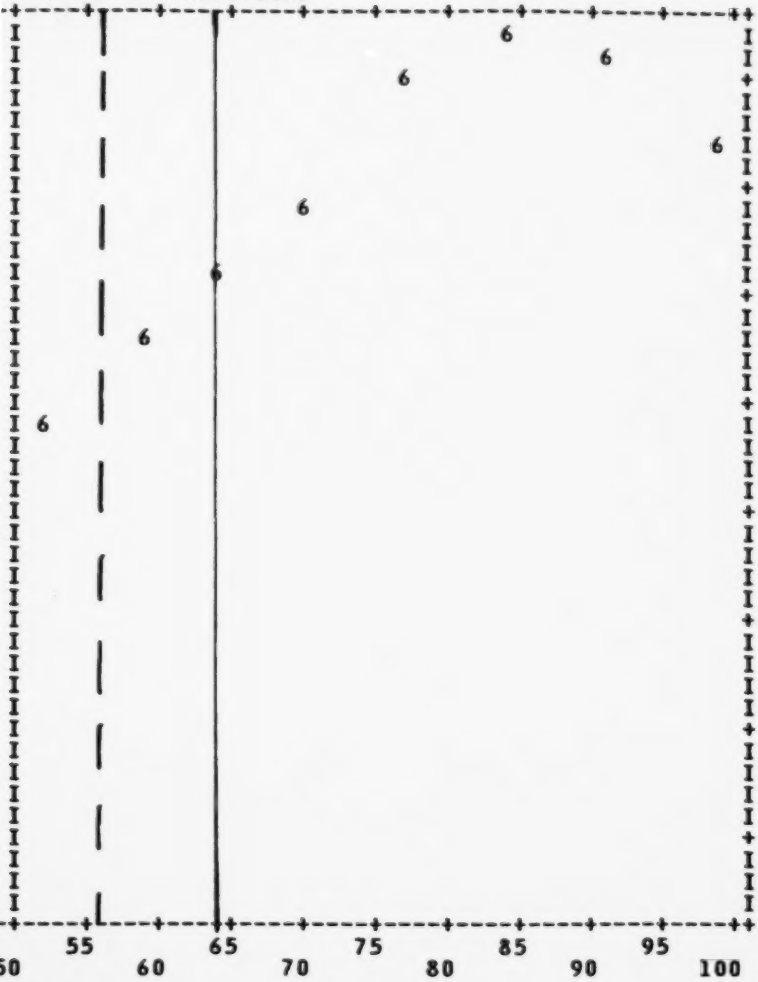
FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:49:24 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



17 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $

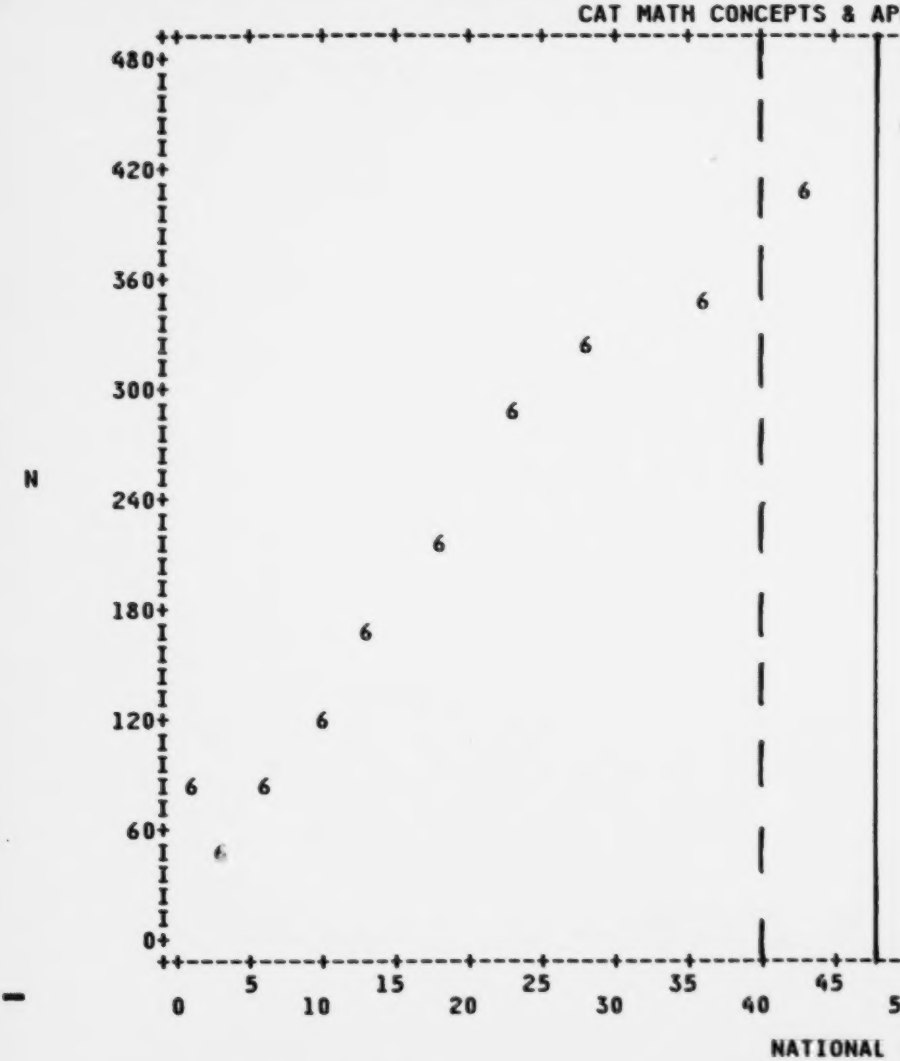
ON SCORE DISTRIBUTIONS



PERCENTILE

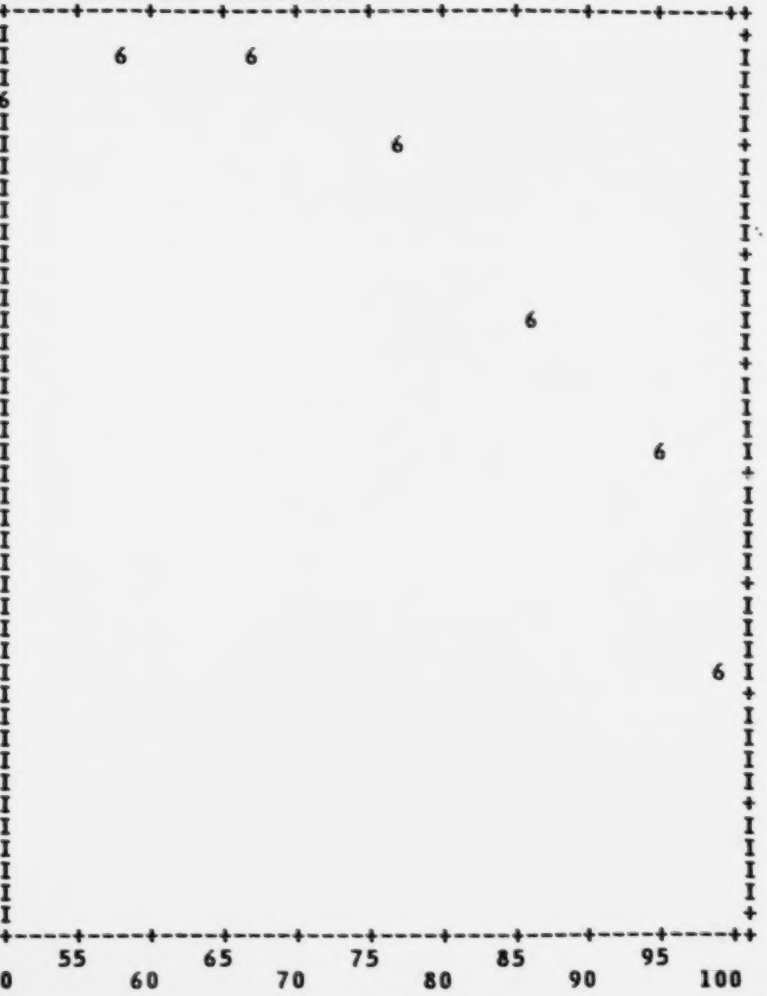
FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:50:30 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



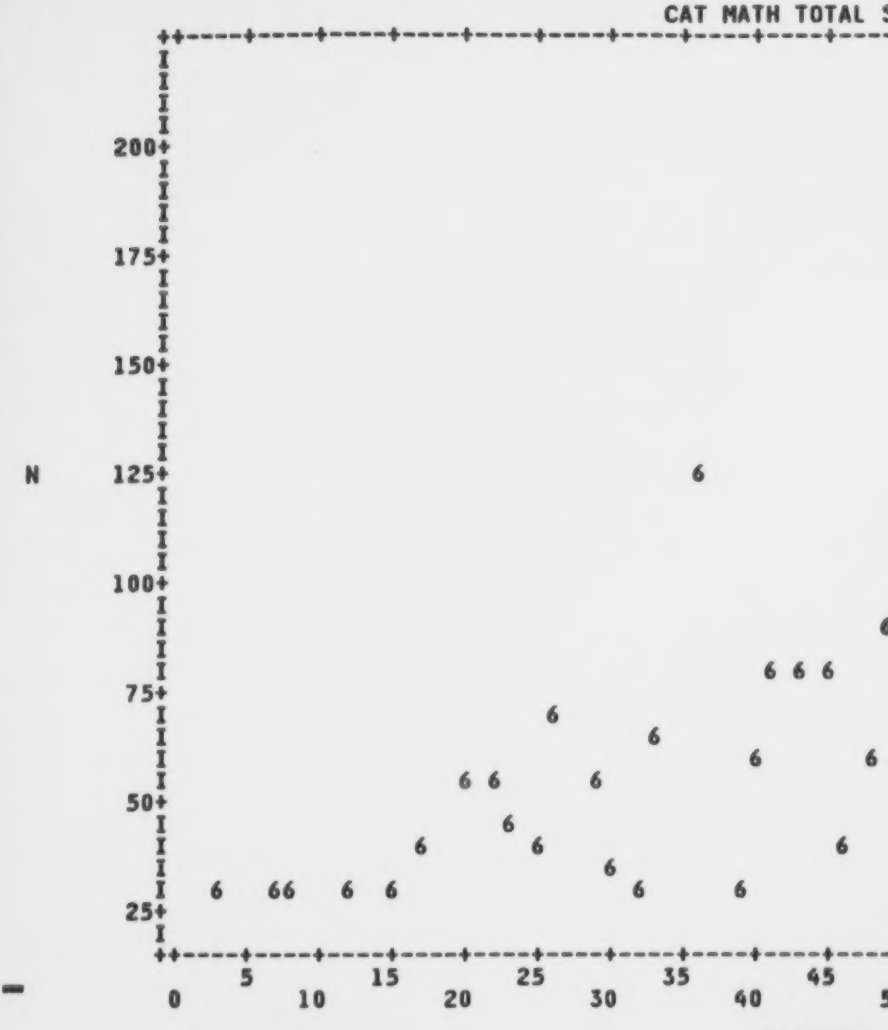
17 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0

PLNS SCORE DISTRIBUTIONS



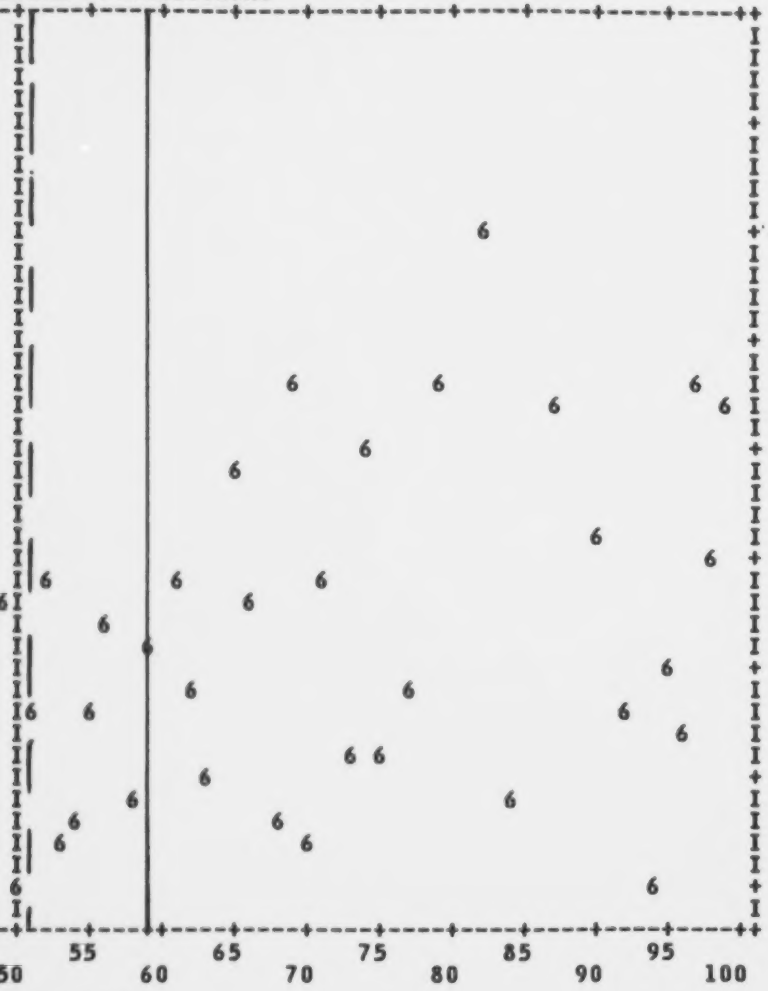
FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:48:19 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



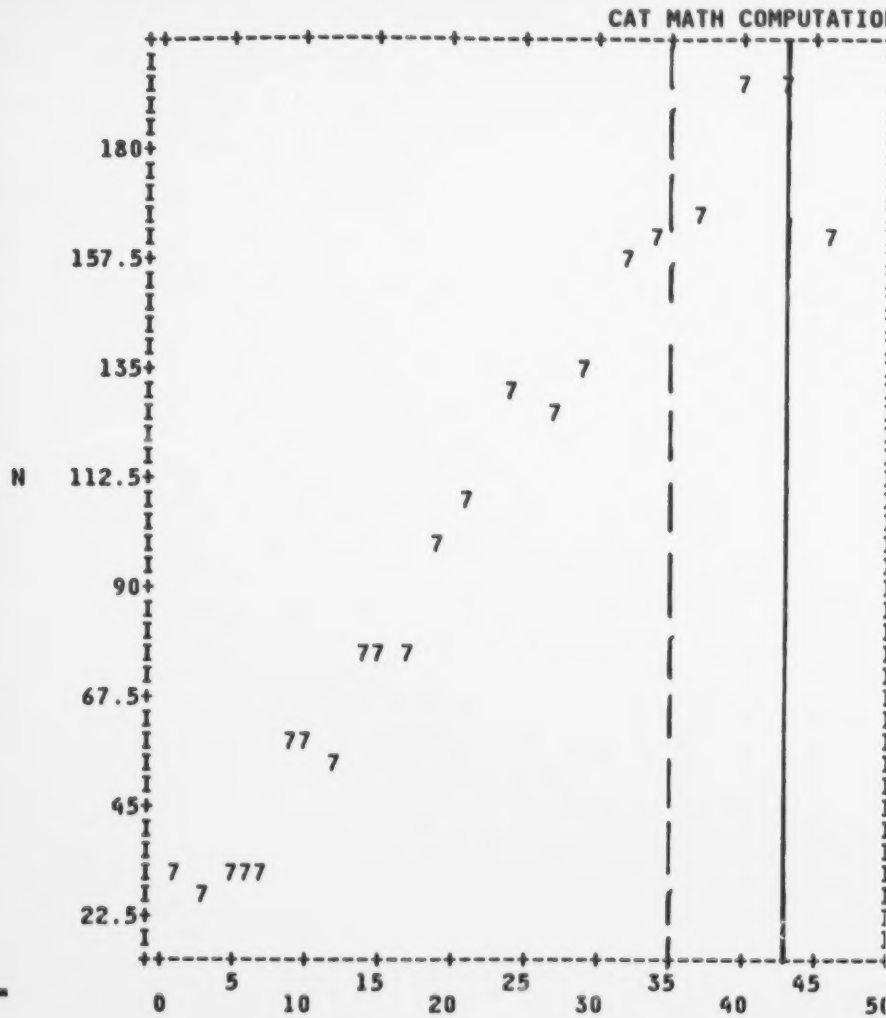
58 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND

SCORE DISTRIBUTIONS



FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:49:24 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



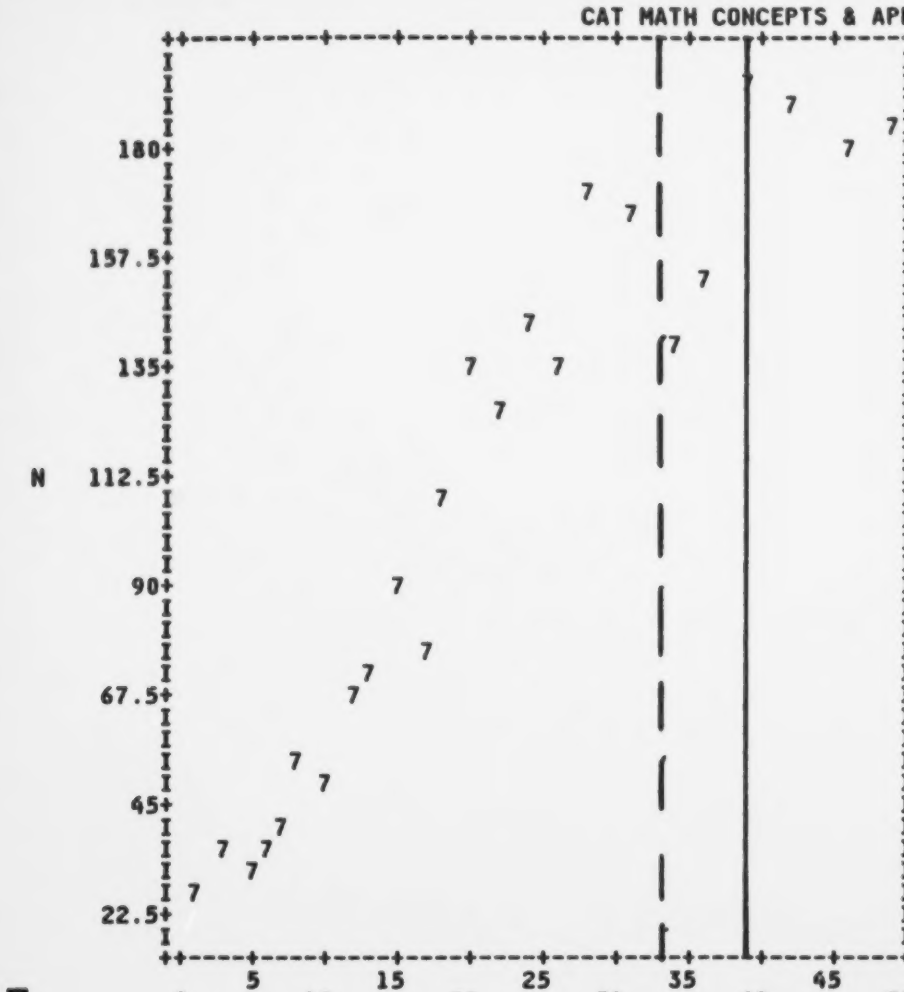
38 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0

N SCORE DISTRIBUTIONS

PERCENTILE

FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:50:30 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



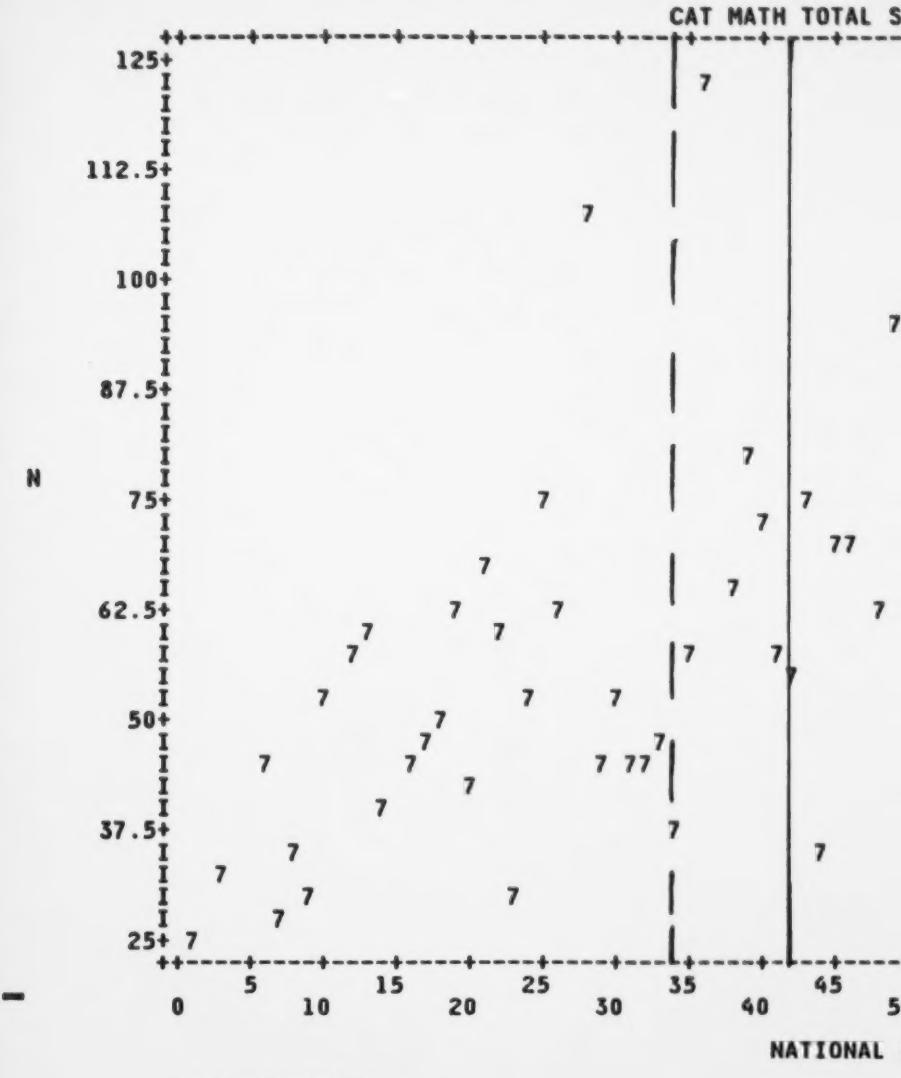
37 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND

PLNS SCORE DISTRIBUTIONS

PERCENTILE

FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:48:20 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY

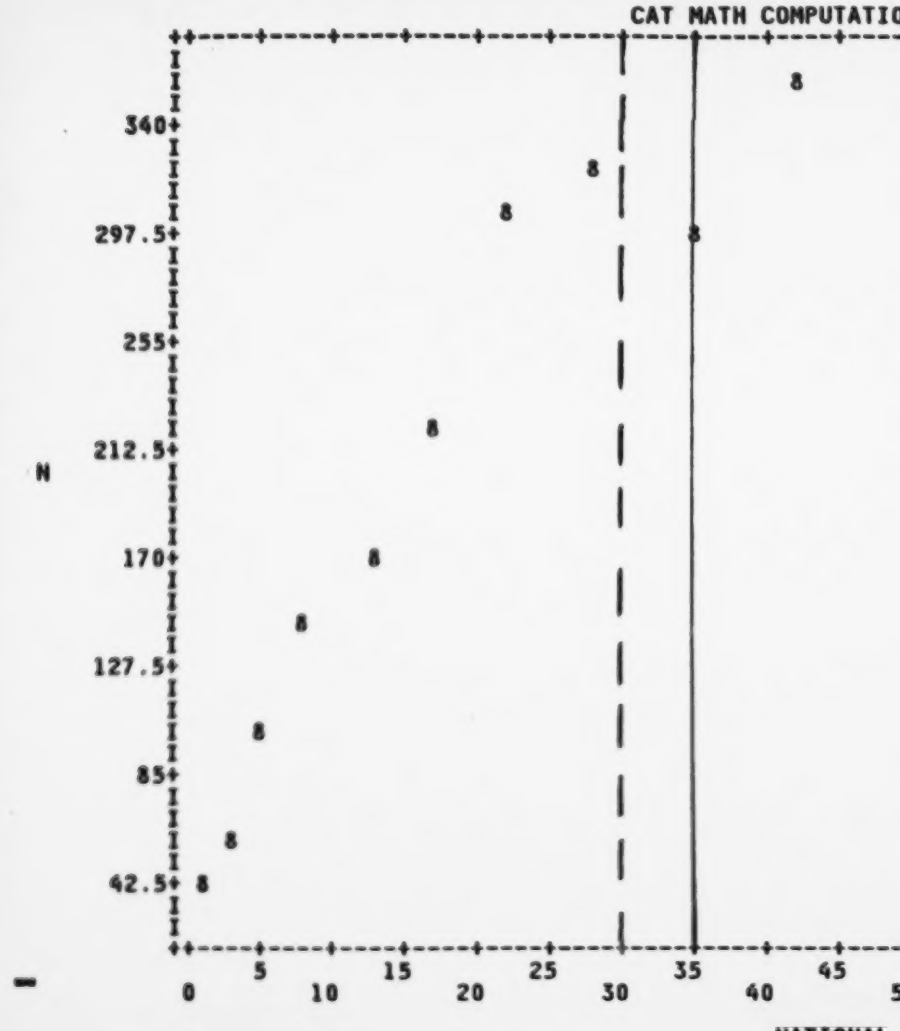


70 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND #

CORE DISTRIBUTIONS

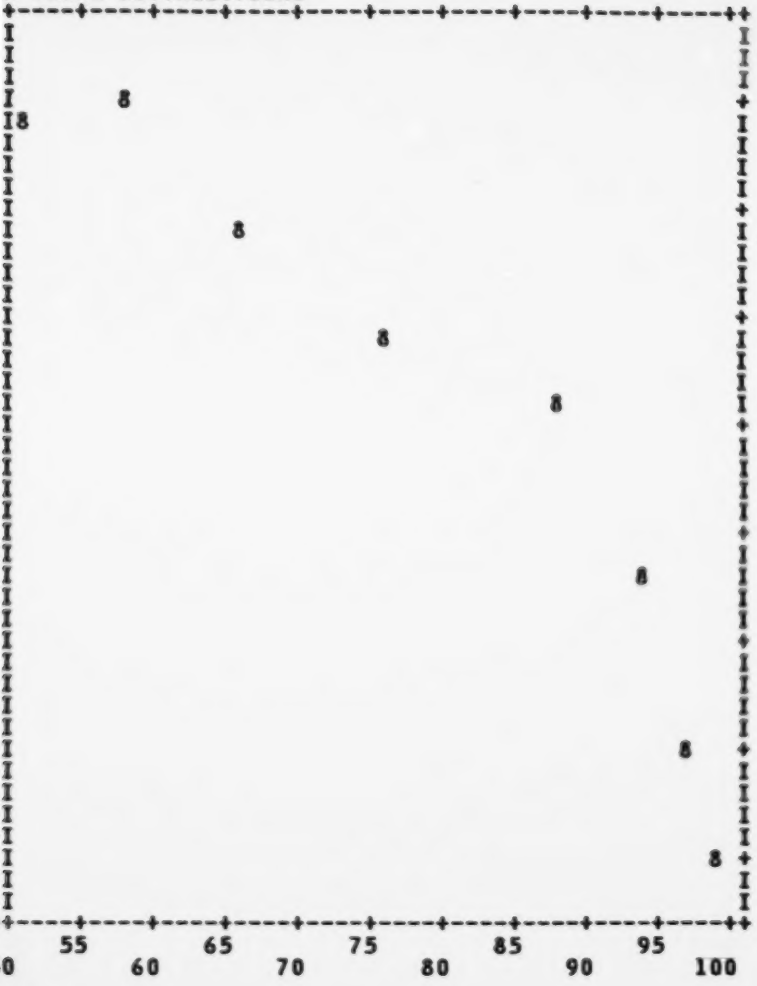
PERCENTILE

FOR MULTIPLE OCCURRENCE.



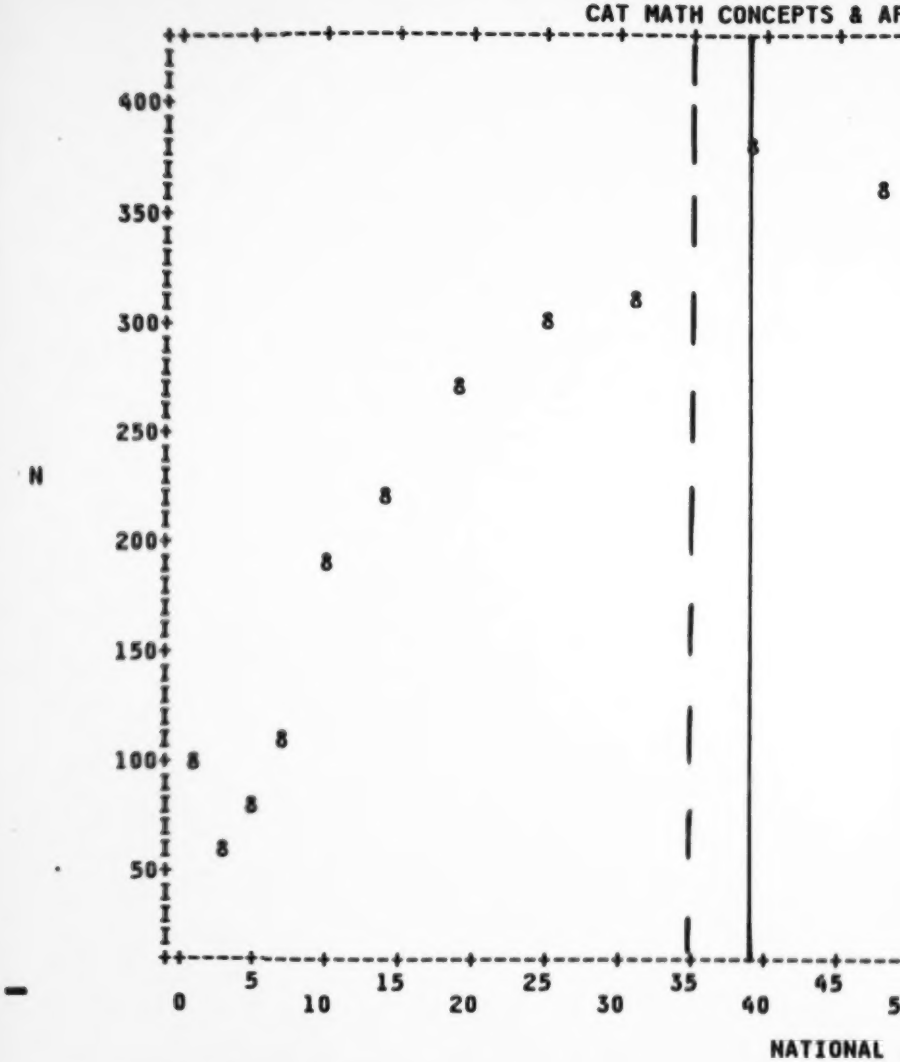
18 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND $

N SCORE DISTRIBUTIONS



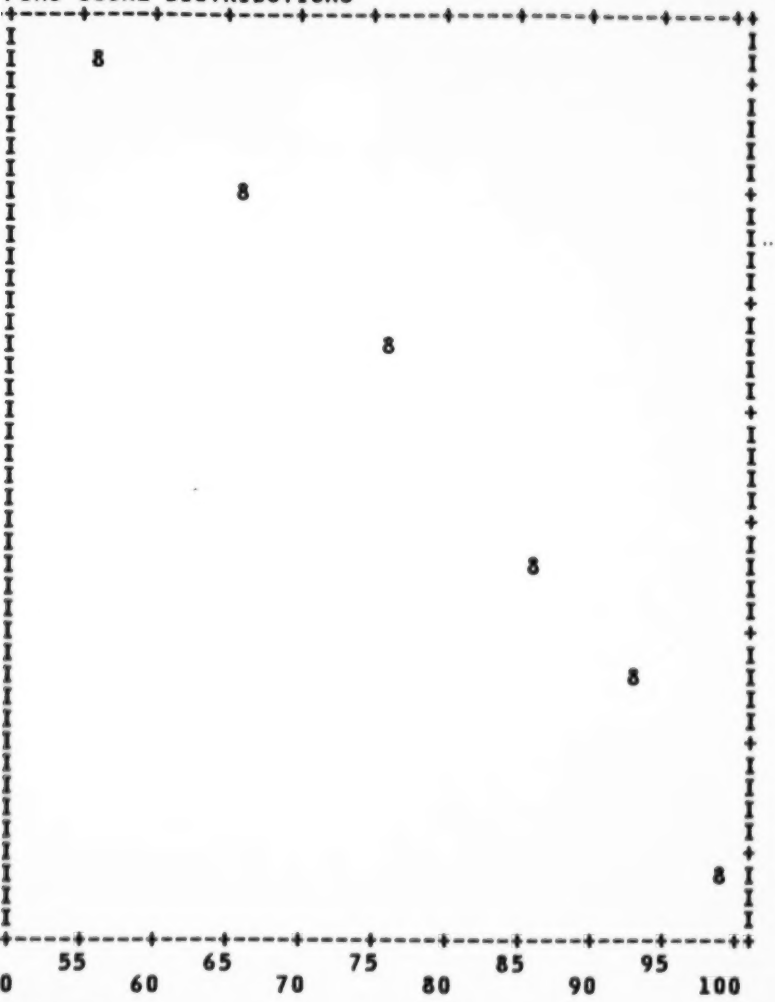
FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:50:30 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



17 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND 0

PLNS SCORE DISTRIBUTIONS



FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
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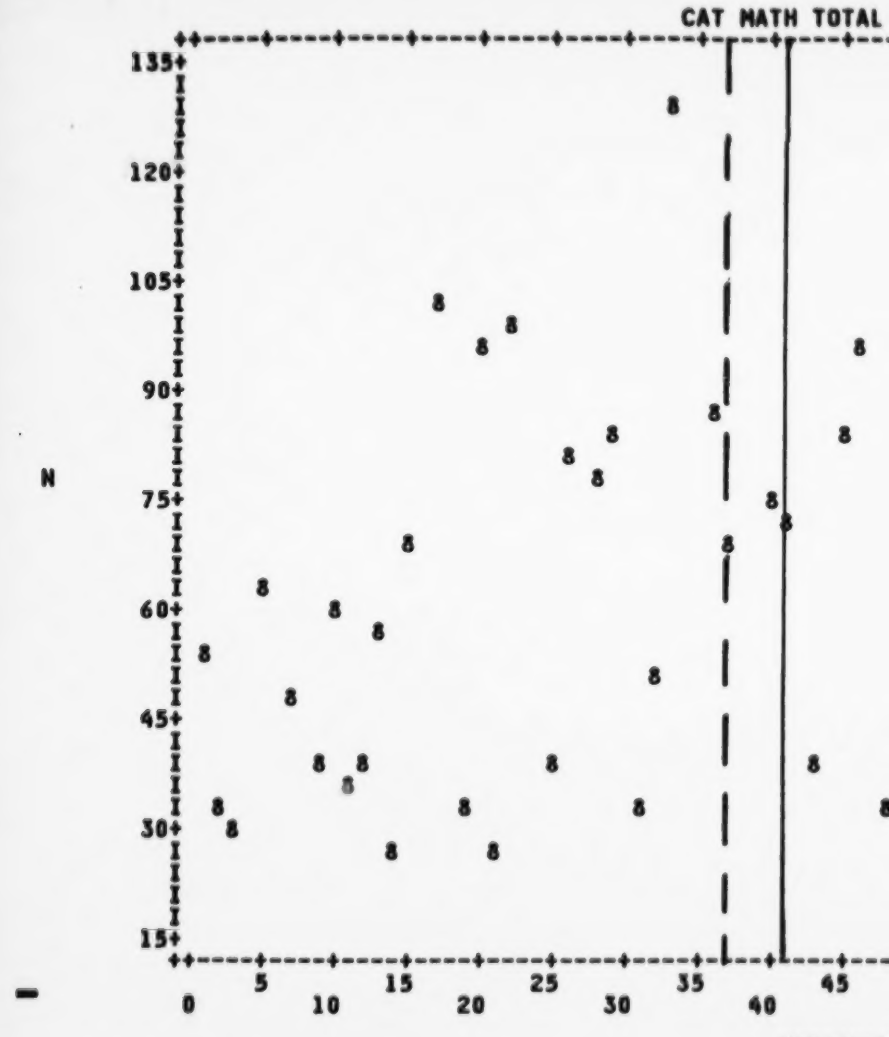
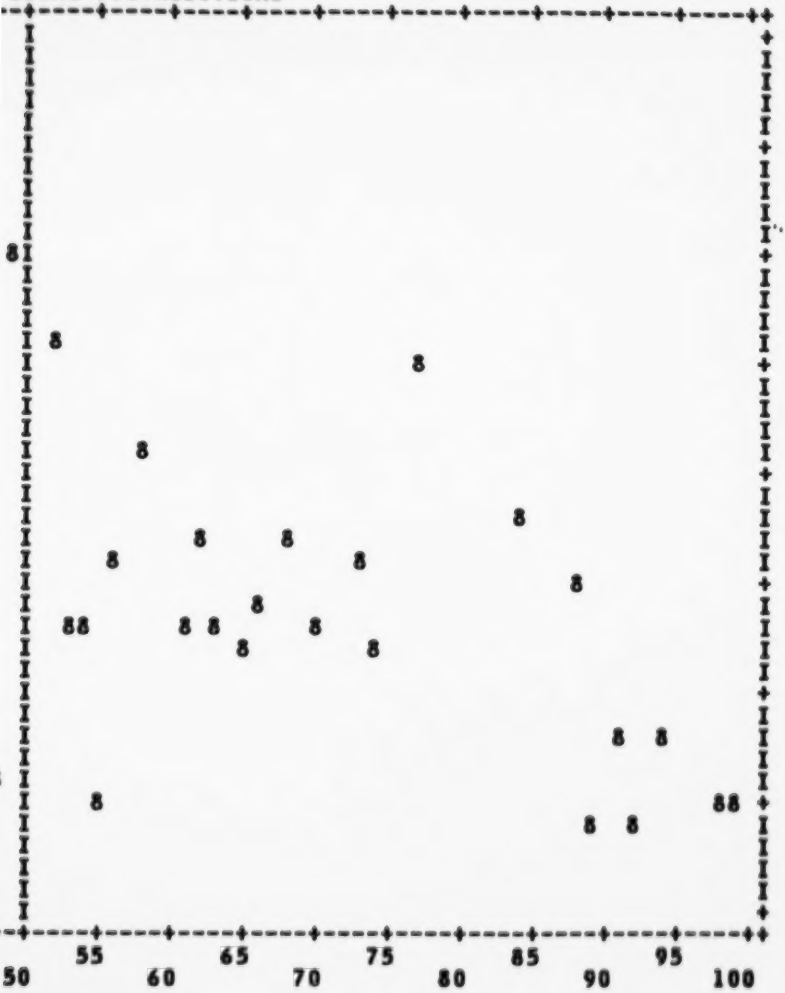


57 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND

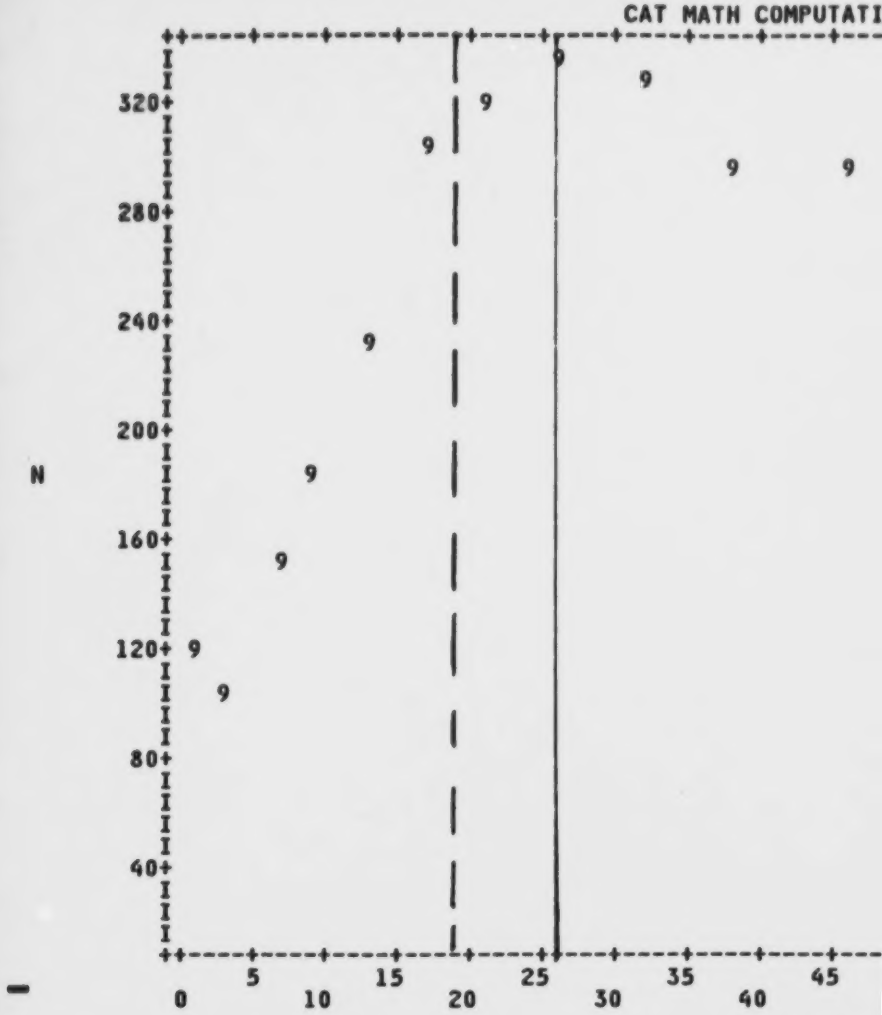
SCORE DISTRIBUTIONS



PERCENTILE

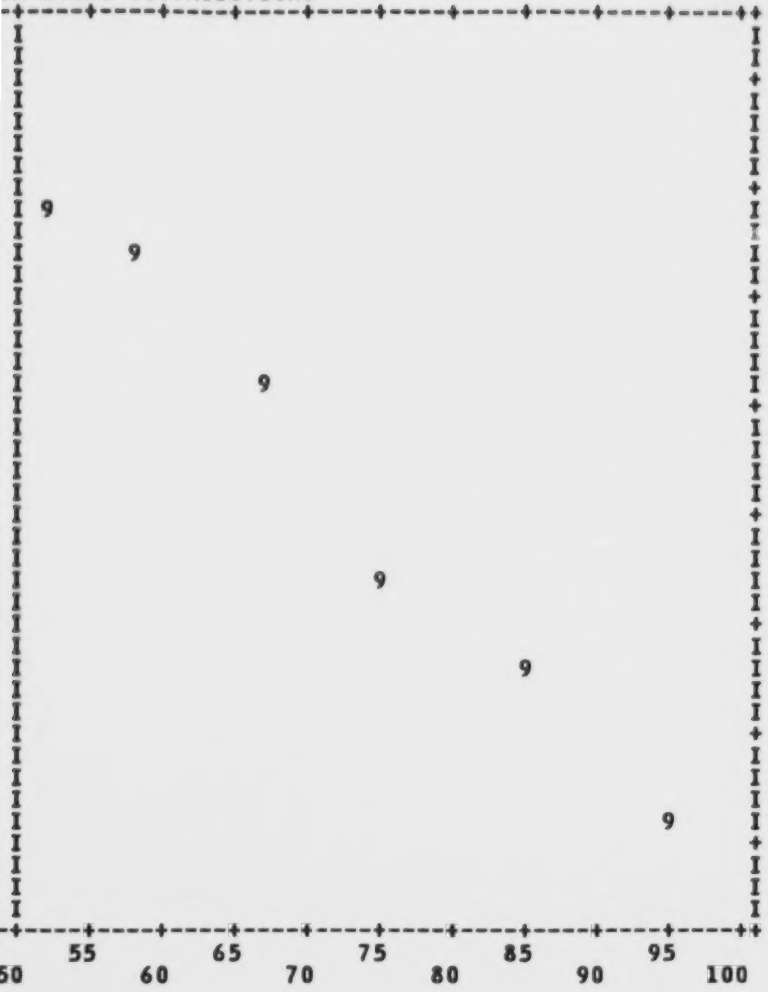
FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:49:25 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



17 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND

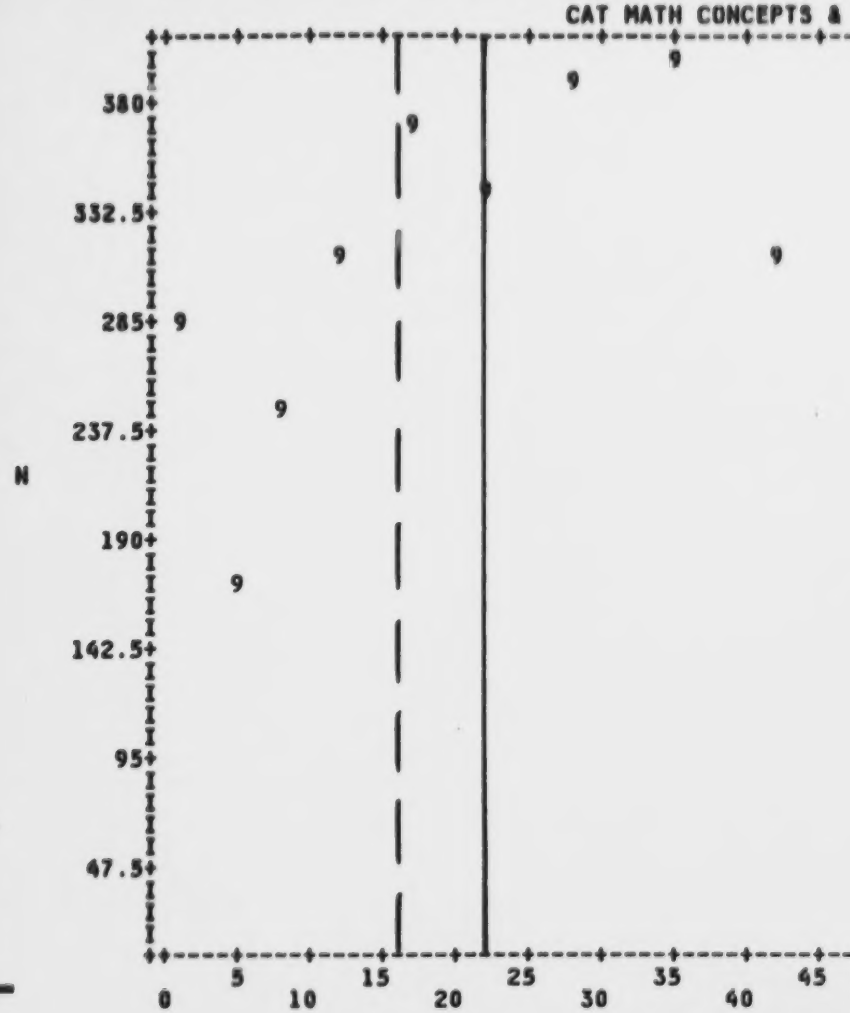
ON SCORE DISTRIBUTIONS



PERCENTILE

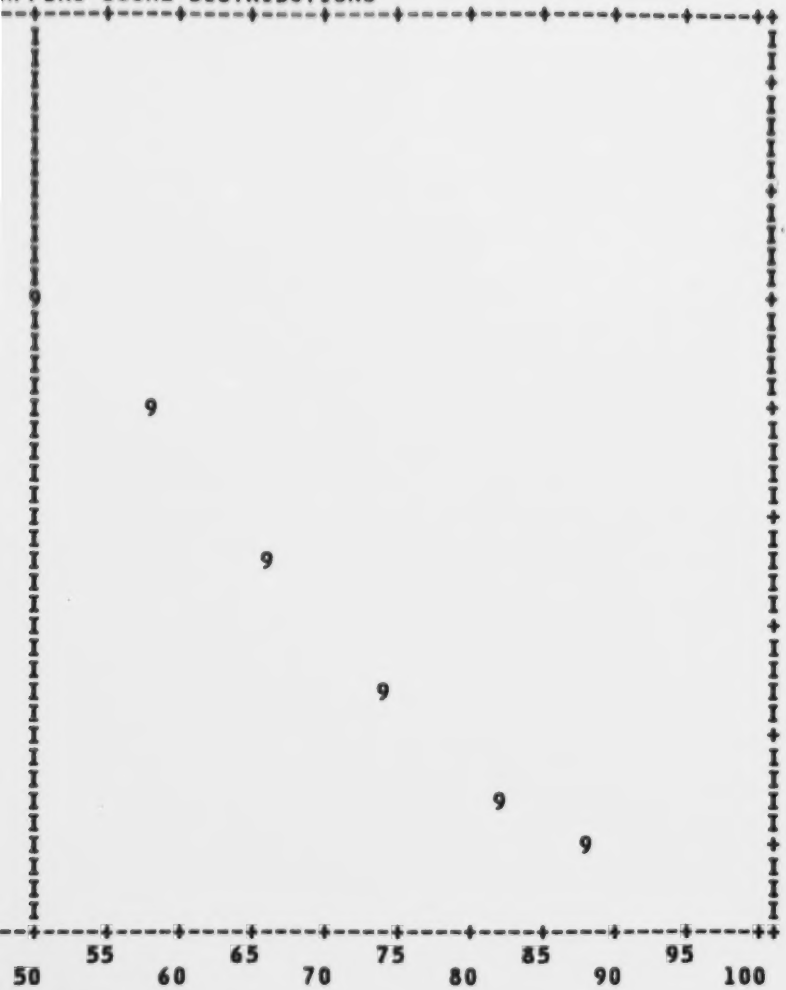
FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:50:31 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



15 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND

APPLNS SCORE DISTRIBUTIONS



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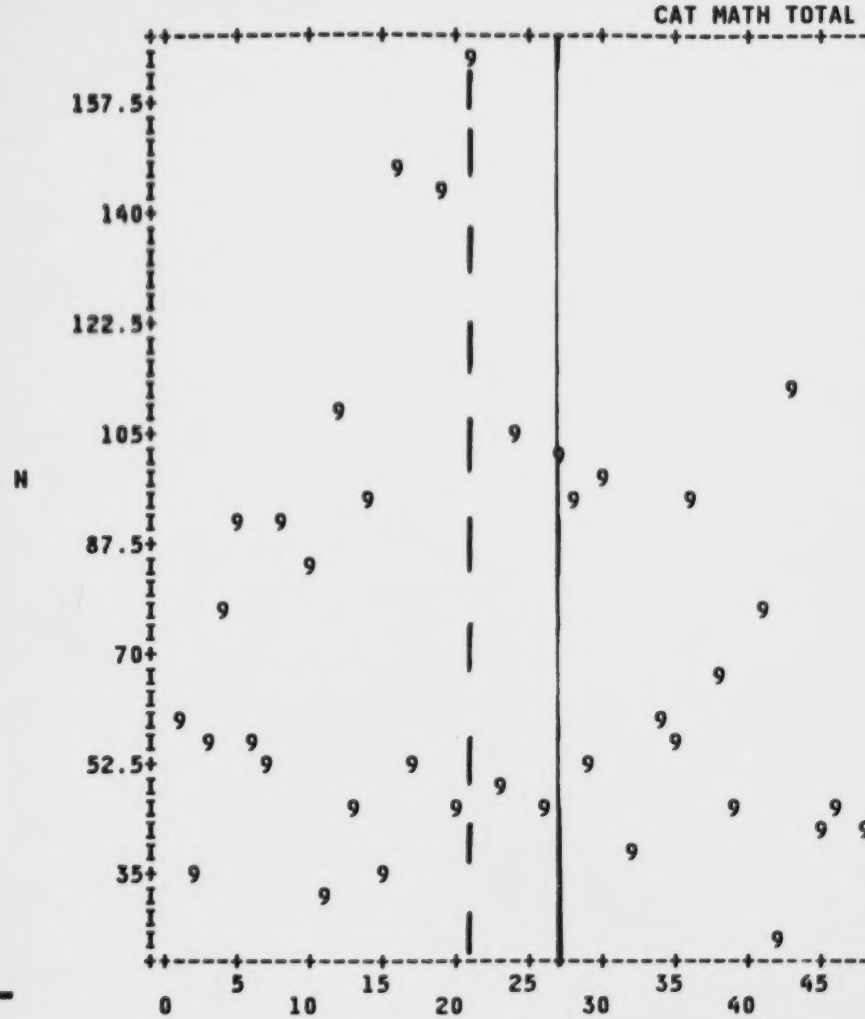
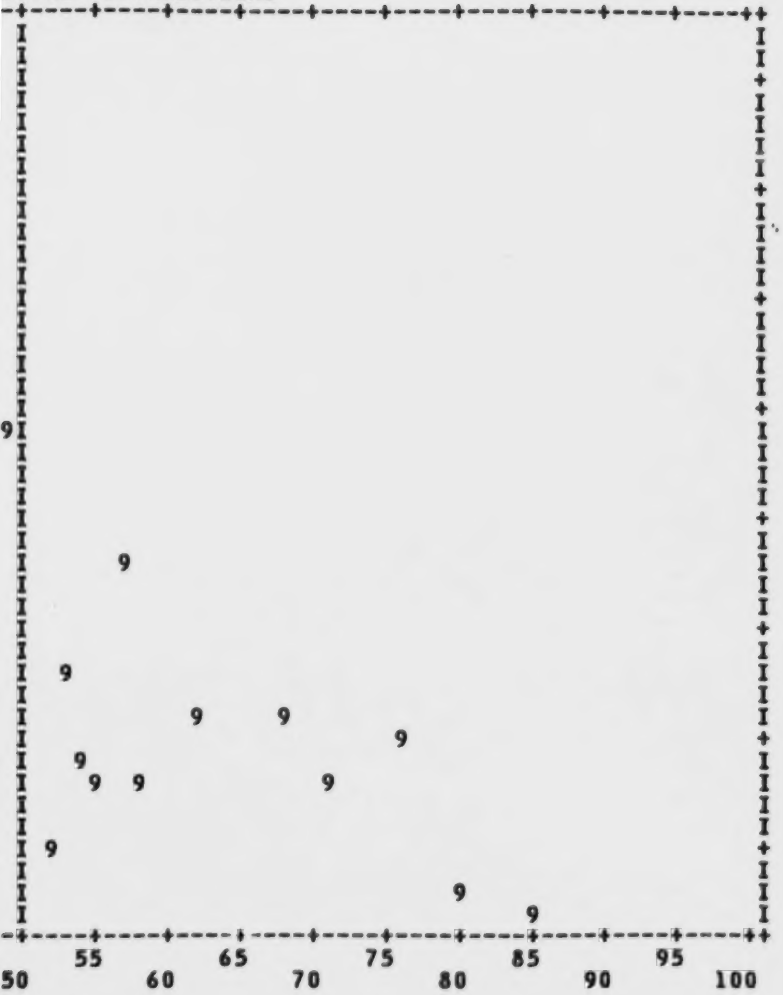
♦ FOR MULTIPLE OCCURRENCE.

14 FEB 90 SPSS21--SPRING MATH TEST SUMMARY
14:48:21 1988 SPRING CLEVELAND TESTING PROGRAM SUMMARY



51 CASES PLOTTED.
USE FIRST DIGIT OF GRADE AS PLOTTING SYMBOL AND

SCORE DISTRIBUTIONS



PERCENTILE

FOR MULTIPLE OCCURRENCE.